

# Aviation Week

*Including Space Technology*

75 cents

A McGraw-Hill Publication

July 7, 1958

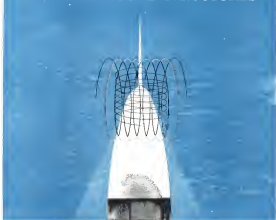
**Vertol Unveils  
107 Turbine  
Helicopter**



North American Sabreliner

## Electronic Device Simulates Human Mind

## FILAMENT WOUND STRUCTURES



### BRUNSWICK CREATES TOOLS FOR THE CONQUEST OF SPACE

Today rocket and missile men are calling for nose cones with strength and stiffness values that were unheard of only yesterday. And these must be produced within seemingly impossible constraints of weight and maximum strength. Not to mention the delicate and dimensional stability which must always be maintained to assure complete reliability.

Employing the super secret Brinckland "B" process, Brunswick research and development teams take these incredibly complex assignments as a matter of course. For they are practitioners whenever the technology of automated glass/robin autoclave components are concerned. They come up with truly practical answers—every time!

As in the past, these same skills are also available for solving your problems in design, fabrication and testing of strength components in metal, fiberglass, conventional metalwork and reinforced plastics. For instant attention, write to: The Brunswick Bolke Cellulose Company, Defense Products Div., 1705 Meador St., Muskegon, Mich.

# BRUNSWICK

MAKES YOUR IDEAS WORK

PAGES FROM AN ENGINEER'S WORKBOOK

**Solution:**  
Goodyear Forged Wheels

**Requirement:**  
Optimum wheels for long-range version of our newest aircraft

**Details:**  
Must have good roll life, best obtainable load weight ratio, no weight penalty.

Available in either magnesium or aluminum depending on specific requirements. Goodyear provides detailed advantages of each regarding weight and cost vs. performance.

#### AIRCRAFT NOW USING THEM:



#### THE SOUND ANSWERS COME FROM



# GOODYEAR

## AVIATION PRODUCTS

TO ADVANCE YOUR PROJECT'S COMPLETION DATE

ADDRESS: Goodyear Aviation Products Division, Akron 10, Ohio, or Los Angeles 54, Calif.



# G. E. REDUCES PREMATURE BURNOUTS

*to cut down your landing lamp  
replacement costs.*

Replacement charges for landing lamps are high. "Grounded" status because of burnouts is even more expensive—and aggravating.

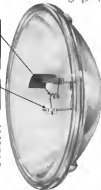
General Electric has done two things to landing lamps to keep both these expenses to a minimum:



**1 RUGGED COILED-COIL FILAMENT**—needs no support wire to prevent sagging, eliminates premature failure caused by "sawing action" of support wire and filament.

**2 METAL STRAPS**—anchor each filament to a flexible wire, insure constant tension wires.

Beam pattern is improved, too, because the compact filament is precisely designed and located to give a cooler beam pattern of more even intensity. Test G-E lamps cost no more—actually cost less in terms of longer burning hours in service.



Ask your G-E Lamp distributor about landing lamp G-159—or write: General Electric Co., Landing Lamp Dept. AW-78, New York, Cleveland 12, Ohio.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**

## AVIATION CALENDAR

- (Continued from page 5)
- Aug. 22-23—Winter Operations Research Engineering Seminar, Fort Collins, Colo., Chautau, University Park, Pa.
  - Aug. 23—18th Annual "Control" Regional Meeting, American Astronautical Society, Chautau, University, Stanford University, Palo Alto, Calif.
  - Aug. 29-30—35th Annual Electronic Meet. & Conference, Institute of Radio Engineers, Silverdale Hotel, Los Angeles, Calif.
  - Aug. 29-30—North Central Congress, International Astronautical Federation, Washington, D.C.
  - Sept. 1-7—1953 Birmingham Flying Display and Exhibition, Society of British Aircraft Constructors, Birmingham, Eng.
  - Sept. 2-12—Physics of High-Speed Aerodynamics Summer Program, Monksville, Pa., Institute of Technology, Cambridge, Mass. (tentative closing, reported)
  - Sept. 3-5—1953 Congress Engineering Conference, Massachusetts Institute of Technology, Cambridge, Mass.
  - Sept. 5-13—1st International Congress of the Astronautical Sciences, Palais Hotel, Madrid, Spain.
  - Sept. 9-11—Second National Conference on Applied Microscopy, Engineering and Other Mech. Program, Chautau, D. C. 11 Postponed, 1954, East Engineering Rm., University of Michigan, Ann Arbor, Mich.
  - Sept. 15-16—Fall Meeting, American Rocket Society, Inc., Hotel Moller, N. Y. C.
  - Sept. 15-16—1st Annual Institute of Astronautics Conference & Exhibit (tentative), in conjunction with the American Astronautical Association, Hotel Philadelphia, Pa.
  - Sept. 20-24—1953 National Professional Group on Electronic and Space Control, American Hotel Ball Harbor, Miami Beach, Fla.
  - Sept. 22-24—Fourth Annual Meeting Scientists, Engineers, Scientists, London Hotel, Philadelphia, Pa.
  - Sept. 25-27—18th Annual National West Coast Lecture, American Astronautical Society, Silverdale Hotel, Los Angeles, Calif.
  - Sept. 29-Oct. 3—National Astronautical Meeting, Society of Astronautical Engineers, Inc., Silverdale Hotel, Los Angeles, Calif.
  - Sept. 29-Oct. 3—New England Meeting and Exhibit, American Astronautical Society, Silverdale Hotel, Los Angeles, Calif.
  - Oct. 6-7—National Symposium on Electronic Design and Space Instruments, sponsored by the Professional Group on Astronautics and Propulsion and Communications Systems of the Institute of Radio Engineers and Group, Washington University, Saint Louis, Mo., Arlington, D. C.
  - Oct. 7-10—1953 Joint Meeting, Institute of the Astronautical Sciences and Canadian Astronautical Institute, Chautau, Ontario, Canada.
  - Oct. 27-28—1953 National Astronautical Symposium, Silverdale Hotel, Los Angeles, Calif.
  - Oct. 27-28—1953 Annual General Meeting of the International Astronautical Association, Silverdale Hotel, Los Angeles, Calif.
  - Oct. 27-28—1st Civil Conference on Astronautics & Astronautical Electronics, Institute of Radio Engineers, Silverdale Hotel, Los Angeles, Calif.



## SUNDSTRAND HYDRAULIC MOTOR POWERS CABIN PRESSURIZATION DRIVE



Two Sundstrand motor models drive the pressurization hydraulic motor used on Alt-Cruiser. One of a standard line offering from 250 to 2,250 in. displacement per revolution, 11.2 to 2,750 horsepower in 10 torque at 2,000 and 2,750 in. 191 horsepower/horsepower from 2,000 psi and rated speed. Ask for Bulletin 124.

Aero Design and Engineering Co. has selected, on a basis of comparative performance, a standard Sundstrand Aviation hydraulic motor to power the cabin pressurization drive of its new Alt-Cruiser.

Standard aircraft hydraulic motors provide long life at continuous duty, high horsepower to weight ratio, high overload capacity, and high operating speed. These characteristics, combined with a wide selection of displacements, assure the right motor for powering a broad range of aircraft equipment.

Other features include few component parts, small envelope, continuous operation of 3000 psi at rated speeds, high overload capacity to 3000 psi on intermittent loads, and high torque to weight ratios for rapid cycling or rapid reversing.

For complete information on Sundstrand hydraulic pumps, motors and constant speed drives for civilian and military aircraft, write today outlining your requirements.



## SUNDSTRAND AVIATION

Division Sundstrand Machine Tool Co.  
3111 Seventh St., Rockford, Illinois

District Offices in: Arlington, Texas; Hawthorne, California; Seattle, Oregon; Redford, Illinois.

Seattle, Washington; Stamford, Connecticut; Washington, D. C.



## THE ELECTRICAL CONNECTOR THAT "WASN'T FOR SALE" BECAME A MAJOR PRODUCT

This is a success story in the true American tradition. It started during World War II. Engineers here at Scintilla Division of Bendix Aerospace Corporation had a problem. The supply of electrical connectors for the aircraft ignition systems we were building was irregular and unpredictable. We were not satisfied with the performance rates we could get them.

Our engineers set out to design the finest electrical connectors available anywhere. We produced them and used them solely as components within our own systems throughout the war. Then, we decided to make them available to anyone in industry who could use them.

In the ensuing years the electrical connector became a major part of our business. The tremendous demand for this product has resulted

in the largest plant expansion in our history, to be devoted to the production of more and better electrical connectors.

We are proud of the recognition of quality which is implicit in your acceptance of Bendix electrical connectors. We are happy to assure you that, while our new facilities will assure even larger production in the future, we shall continue to place greater emphasis on quality than on quantity.

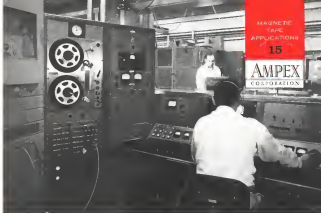
We hope you are already familiar with Bendix electrical connectors. If you're not, may we offer our assistance in solving any connector problems. SCINTILLA DIVISION OF BENDIX AEROSPACE CORP. BENTON, N. Y.

Scintilla Division, Bendix Aircraft Corp.,  
201 Lexington Road, Benton, N. Y., 13620

**Scintilla Division**  
BENTON, NEW YORK



A line of major types and sizes of standard and special Bendix electrical connectors that engineers are likely to find you with the most accurate connector replacement.



MAGNETIC  
TAPE  
APPLICATIONS  
15  
**AMPEX**  
CORPORATION

## How to improve component reliability by better shake tests Magnetic tape simplifies complex-wave testing and lessens human error



Many of the components that get their first ride on the tape-driven shaker are now ending the ride in flight—on our first successful earth orbiting. It is highly significant that the California Institute of Technology Jet Propulsion Laboratory which led the development work on this satellite also pioneered complex-wave vibration testing. In this technique, magnetic recording plays many vital roles.

### THE WAY TO OUTQUEST THE UNKNOWN

Is simple sine-wave vibration testing sufficient? Or is a closer simulation of the satellite's actual vibration environment a necessity? Results are not the same. Successful simulation often demands knowledge more complex than the complexities of a realistic test itself. Shaker components can lose under the weight of excess safety factors for the sake of confidence—reason why JPL chose motion meter and complex waves.

Simulated vibration tapes from actual missile flights are often used as shakers to assist development of test procedures. But this is not a complete answer. Different flights yield different vibration environments. A more ideal test-programming tape is a synthesized composite or envelope of the most adverse conditions from many flights. This tape often combines random noise of engine vibration and complex waves from aerodynamic properties and structural movements. And just as the satellite's mass, velocity and surrounding atmosphere will change rapidly with time—so the taped program must change too.

Once an magnetic tape, any test program steps adjust. It is repeatable without tedious setup and time-consuming control of separate signal sources. With a properly calibrated tape, there is little chance that an operator will accidentally create destructive forces by errors in frequency or gain settings. Tape eliminates many possible sources of human error. It also insures personnel free to concentrate on other requirements of shaker operation and test observation.

### TAPE PASSES ALONG THE "IDEAL" TEST

So that no contractors and subcontractors will not demand shake tests correctly on the components they launch, Caltech JPL frequently sends them program tapes. These contain calibration data to adjust to the program itself. Then a smaller shake-table setup on the other side of the country can exactly duplicate the tests run at JPL's own laboratory. The tape leaves chance of misinterpretation and subjective factors.

As quality production of missile components gets under way, magnetic tape offers a means to run optimum shake tests on large numbers of components at widely separated manufacturers. From copy tapes, test programs of complex waves can be run almost as easily as a simple sinusoidal scan. Individual users need not have equipment to generate their own shaker-control programs. Some contractor or research co-contractor can furnish the tape. And since any number of duplicates can be made, a well-rehearsed test program can have unlimited circulation.

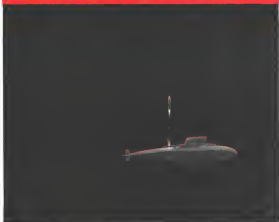
May we send you our 15-page brochure on magnetic-tape instrumentation plus further information on the use of tape for vibration testing? Write Dept.

AMPEX INSTRUMENTATION DIVISION • 320 CHARTER STREET • REDWOOD CITY, CALIFORNIA  
Name, post office address, telephone and zip for letter address. Do you already have? Office only. U.S.A. and Canada. Delivering representatives call for this mail.

## AEROJET for rocket power: the Navy's Polaris

The powerplant for the submarine-based POLARIS will be an Aerojet solid-propellant

rocket engine developed and manufactured at our Solid Rocket Plant near Sacramento



A SUBSIDIARY OF THE GENERAL TIRE & RUBBER COMPANY

For more information—investigate outstanding opportunities at Aerojet (Photos in Boston and near Sacramento, Calif.)



**HI-CAPACITY CENTERPIECE** Capable of handling 100 pound objects at 100 ft. 10 g's constant acceleration.



**ALTITUDE CHAMBER** Capable of simulating altitude up to 100,000 feet, Temperature Range—200° F. to -40° F. Moist. up to 95%; Capable Rate 10 ft. per sec.



**SALT SPRAY TEST CHAMBER** Capable of temperatures from 40° F. to 150° F., Humidity to 100%. Specimen capacity up to 100 cubic feet.

## ENVIRONMENTAL TESTING & ANALYSIS

### to foretell the performance of your products under actual service conditions

The personnel and facilities of Bell Aircraft Corporation's General Engineering Laboratories are now available to you in testing and analyzing the performance of materials, components, systems and packaging under environmental conditions duplicating those which will be encountered in actual use. Years of operational behavior frequently can be simulated in hours in the laboratory.

Extensive and diversified experience in such fields as automation, electronics, nuclear physics, servo systems, guided missiles, rockets and aircraft currently qualifies Bell engineers to handle your most exacting assignments quickly and competently. Qualified Product Test (QPE) testing and Military Certification of tests are available. All equipment used complies with the requirements of MIL-E-13122A.



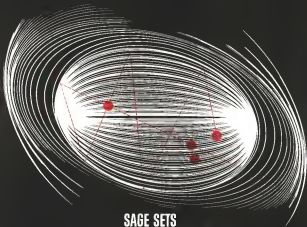
**EXPLOSION CHAMBER** Capable of temperatures from 60° F. to 100° F., Altitude to 10,000 feet, Capacity 10 cu. ft.

ACOUSTICS • IMPACT SHOCK • ACCELERATION  
VIBRATION • TEMPERATURE • ALTITUDE  
HUMIDITY • SAND AND DUST • EXPLOSION  
FIRE • SALT SPRAY • BOMBING • RAIN

Additional information and a copy of Bulletin EL-1, "Environmental Test & Analysis", can be obtained by contacting John Thompson, Special Weapons Division, Room 3124, BELL AIRCRAFT CORPORATION, Post Office Box One, Buffalo 3, N. Y.



Buffalo Weapons Division  
BUFFALO, N. Y.



## SAGE SETS AN ELECTRONIC "BEAR TRAP"

### BURROUGHS ELECTRONIC DATA PROCESSING EQUIPMENT STANDS WATCH FOR OUR CONTINENTAL AIR DEFENSE

Problems of the awesome speeds and range that confront our military defense systems can only be solved by the quick and accurate processing of electronic information, such as it found in our Semi Automatic Ground Environment—SAGE, which is now becoming operational. As a result Burroughs radar data

processing equipment fills important parts all along our peripheral continental approaches.

This major U.S. Air Force contract is one example of the widespread confidence in Burroughs Corporation's 70 year background of reliability and capability. It demonstrates Burroughs' new breadth in the development of electronic equipment and its continuing competence from research to final installation.



**Burroughs Corporation**

"NEW DIMENSIONS" in electronic and data processing systems

# NEW ICEFOIL

Meets requirements of MIL-D-8181 plus 2000 cps @ 15G  
Vibration Test plus 1450 ft.-lb. Ice-Ball Impact Test

The new AeroProducts ICEFOIL is specially designed for installation in the intake duct of gas turbine engines. Combining simplicity of design with maximum weight and minimum strength, the ICEFOIL offers a truly modern ice detection system for jet-age military and commercial aircraft.

Its standard NACA airfoil shape cuts drag and air turbulence to a minimum. Its positive/positive pressure system provides a built-in fail-safe feature—given longer life with greater reliability. Requiring no periodic calibration or adjustment, ICEFOIL presents ice warning in the cockpit or automatically activates de-icing systems at speeds from 50 to 550 knots.

Currently in production for the Douglas DC-8 commercial jet transport, ICEFOIL is available for immediate applications on engines, airframes, missiles and rockets.

*Building for today... Designing for tomorrow*  
**AeroProducts**

ALLISON DIVISION OF GENERAL MOTORS  
DAYTON, OHIO





## BIG EXTRUSIONS

...from Harvey Aluminum

improve design  
reduce weight  
lower assembly costs

**BIG EXTRUSIONS** — 3 feet wide and wider, as long as 80 feet — are being made by Harvey Aluminum. For information on BIG aluminum extrusions, tell us your shape, too, write direct to Harvey Aluminum, Torrance, Calif., or contact the nearest Harvey Aluminum factory branch listed under "Aluminum" in your classified directory.

**HARVEY**  
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It makes today's new products of quality aluminum in all standard sizes. Flat, square, tube, and bar. Also, extrusions, angles, channels, I-beams, and other shapes. Special shapes, light and heavy, even some alloy, space extrusions and other aluminum products. Single products or complete fabrication. Call or visit HARVEY ALUMINUM, 8441 E. 19th, Torrance, California.

Holley  
engine  
controls  
selected for  
JT4 engines  
on America's  
first jet  
airliner



BLEED PISTON ACTUATOR



COMPRESSOR BLEED GOVERNOR



Powered by four JT4 Pratt & Whitney Aircraft engines, the Boeing 707-320 will carry 121 first class passengers from New York non-stop to the Continent in just over six hours! Each of these new engines, commercial counterparts to the J-75 which drives many of America's latest jet fighters, delivers up to 13,000 pounds of thrust. Ability to pack so much added power into a relatively small space is the result of designing engine components which will operate at higher efficiency, require less area and reduce overall weight. Holley Carburetor Company, work-

ing closely with Pratt & Whitney Aircraft engineers carried out this exciting assignment on such vital engine components as the compressor bleed governor, and the bleed

governor actuator. For single and multi-engine arbitrary controls, the Holley main fuel control is a companion unit to the Holley governor and actuator.



**HOLLEY**  
Carburetor Co.

15115 E. New Mile Road, Warren, Michigan  
Leader in the Design, Development and Mass  
Production of Aircraft Fuel Metering Systems

For military applications, the Holley main fuel control (right) is a companion unit to the governor and actuator.





HOW MODERN **T58** POWERPLANT HELPS PROVIDE . . .

## 700 Lbs More Payload Capacity

NEW SIKORSKY S-62 COMBINES PROVEN HELICOPTER COMPONENTS  
WITH PROVEN GENERAL ELECTRIC T58 TURBOSHAFT ENGINE

Sikorsky's newest helicopter combines the components of its famous S-55—proven in 1,000,000 flight hours—with modern General Electric gas turbine power, supplied by the compact, high performance T58. The result: a helicopter that provides 700 lbs more payload capacity . . . and more cabin space to carry it in . . . than the S-55.

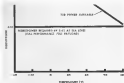
Capable of operating from either water or land, the S-62 is a highly versatile helicopter. Powered by a single T58, the S-62 will be qualified to perform a wide variety of missions. It will provide . . .

... *insurance flight capability.* Today's helicopter requires about five minutes warm-up time. The T58 turboshaft requires no warm-up.

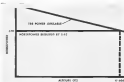
... *more power for hot weather flight.* From its single T58, the S-62 will have substantially more horsepower than the S-55, especially for high altitude or hot weather flight.

... *unequalled hovering ability.* The T58 will provide the full power required by the S-62 up to 17,000 feet.

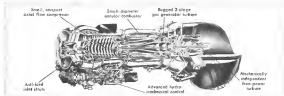
The S-62 is another striking example of the performance helicopters can get with the modern T58 turboshaft—the engine which provides more horsepower per pound of weight than any other shaft engine flying today. For new T58 technical information brochure, write to: General Electric Co., Section 438-10, Schenectady 5, N. Y.



Regardless of temperature, T58 will automatically provide S-62 the total horsepower it requires at sea level for full performance, full payload in addition, operating the T58 at less than top design horsepower increases engine life.



At altitudes up to 17,000 feet, T58 will supply full horsepower requirement of S-62 . . . helps insure unequalled hovering ability. This outstanding altitude and hot day performance is possible with an engine having a level of performance allowed only by the T58.



General Electric produces T58 delivers 1000 shp, weighs only 271 lbs without 75-lb optional reduction gear. Its near 4 to 1 power-to-weight ratio, 9.64 SFC give added insurance of top helicopter performance.

*Progress Is Our Most Important Product*

**GENERAL ELECTRIC**



API\*





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INDUSTRY WORKS, INC.  
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High Temperature and Fluids are specialized  
and a full line gas equipment  
regulation systems and associated systems

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**A PRICELESS INGREDIENT - DIRECTION CONTROL**

- regulating inlet pressure: 100-5000 p.s.i.
- outlet pressure: 30-500 p.s.i.
- flow rates: 5-50 lbs./min.
- extremely close regulation and lock-up range
- integral full flow relief valve
- invariable as automatic adjustments
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**USAFE's Mercy Missions**

During our recent swing through Europe visiting NATO air bases we were impressed with how much genuine good will and mutual respect is being generated among European and American military personnel with spontaneous and relatively low cost openness in contrast to the results produced by some of our formal and expensive aid programs. This type of activity may range from nothing more than having a local community's basketball team to level a soccer field or provide a band for a local festival to the large scale mercy missions operated by United States Air Forces in Europe and flown by the 322nd Air Division (Forward Support). We had several examples of this mercy mission story in many parts of Europe as we traversed 70 miles northwest of Paris where the 322nd headquarters in Evreux Air Base nestled in the rolling hills of Normandy, to get the whole story from its current commander Col. Clyde Boy and his staff. The 322nd now has one of its two wings on patchwork equipped with Lockheed C-119 Hercules bi-prop transport. But most of the mercy missions that have made such a lasting impression in Europe have been those flown with the Fairchild C-119 and the Douglas C-124.

Last year when the worst locust plague in North African history began devastating crops in Tunisia the 322nd airlifted 800,000 lb. of rice to feed in three days from Morocco to supply crop-dusting aircraft, help crops and land operated during crop fighting the pests. Shortly thereafter the locusts hit Morocco and the 322nd pitched in with another critical airlift of rice to feed from Algeria to the arid areas. The year 1966 was a rough one in Europe and the 322nd made major contributions in alleviating the disaster caused by rain and drought. Early in that winter heavy snows isolated thousands of Greeks in the mountainous areas. In response to an appeal by the U.S. Ambassador in Greece, the C-119s of the 322nd parachuted more than 100,000 lb. of food and clothing to the snowbound villages. Later in February, 1966, the 322nd executed Operation Snowbird which carried some 700,000 lb. of food, clothing and blankets from German bases to Italy, Sicily, and Sardegna who had been cut off from almost food and fuel supplies by the worst snowstorms to hit these areas in 50 years.

Earthquakes rocked Lebanon in mid-March of 1956 and again the 322nd transports relief blankets, tents and medical supplies to the affected area from Saudi Arabia and Mexico. In the fall of 1956 revolution broke Hungary and the human debris from this violent attempt to throw off the yoke of Soviet rule swelled into Austria. A C-119 Bee, an 8000 lb. and five tons of medical supplies from England to Vienna, and other transports rounded up bedding and men gear for 5,000 prisoners from USAF bases in Wiesbaden, Garmisch and Bamberg. This gear was afloat to Munich for rail shipment to Austrian refugee camps.

When fighting flared around the Saar canal the 322nd provided emergency evacuation for over 500 civilians to Aachen and Bonn and later airlifted nearly 1,500 United

Nations troops and their supplies from Denmark, Norway, Sweden and Finland to the Naples staging area of the force that policed the Saar valley zone.

The 322nd Air Division and other USAF transport aircraft also provide an annual "Kinderlift" which for the past five years has transported German refugee and underprivileged children from Berlin to West Germany for vacations in the country. This "Kinderlift" is operated in cooperation with the German Red Cross and provides safe conduct for refugees from East Germany who could not travel safely by land through the Soviet occupied area of Germany. Last year 2,000 children were given round trips by air from Berlin. The 322nd also operates a medical air evacuation squadron that does emergency missions for American tourists stricken abroad flying them to the nearest hospitals that can handle their problems.

All of these activities of course provide excellent training for the 322nd and ground crews and aerospace education at their transport aircraft. But they are also building a better world around Europe's good will and respect with these spectacular and unselfish mercy missions.

**Price of Progress**

The crash of the Boeing KC-135 jet tanker shortly after takeoff from Wurtsmith AFB on an attempted second loading run to England was one of those tragedies that inevitably jeopardizes the story of continuing technical progress. Aviation had some devoted contributors to its technical progress and public understanding in this accident.

We thank Gen. Thomas White, USAF Chief of Staff, expressed the thoughts of us who work in this business and who personally knew many of the men involved when he wrote:

"The moment in which these men had embarked was a moment that in every respect except that it was a disaster, it was a demonstration of a new capability of the United States Air Force as one of the principal guardians of world peace. In order that the people of the United States and of other nations may learn and understand the steps by which we are diminishing the time and space that separates the nations of the Free World, we have often shared these notable experiences with men who are trained to observe and to report them. As we share with these men the conquest of time and space, they share with us the dangers of that conquest."

This unfortunate accident opens to a reminder to all of us that the men who observe and report the achievements of science and skill that are so necessary to our survival are partners in these achievements. They are also partners in the sacrifices that sometimes are the price of progress. The men who represent the world's need to know, and who in peace and in war share the dangers and the fate of our men in uniform, are equally worthy of the nation's gratitude."

—Robert Holt



## Seventy-five Years

**T**HERE WAS a growing surplus in the United States Treasury—the Polygram Act was passed—the bridge was refused from three cents to two cents—the Brooklyn Bridge was opened—decided time was achieved—in 1885, when two young men, just graduated from Worcester Polytechnic Institute, established the business bearing their names—WYMAN-GORDON. The total capital was \$27,000. Integrity, initiative, ambition and ability were theirs. Endowed with these qualities and privileged to operate

under the unique American system of free, private, competitive enterprise the Company prospered and grew.

On this our 75th anniversary, we salute the spirit of our founders and we pledge our every effort to help preserve, against the steady erosion of the last quarter century, that system which has made our nation what it is today and which has enabled us to build the greatest industrial production in the world, resulting in the highest standards for all segments of our people.

## WYMAN-GORDON COMPANY

(INCORPORATED 1910)

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM

HARVEY, ILLINOIS • WORCESTER • MASSACHUSETTS • DETROIT, MICHIGAN

## WHO'S WHERE

### In the Front Office

Leslie Farnell, board chairman, and Harry Gaylord, senior vice president, Bell Aircraft Corp., Buffalo, N. Y. Mr. Farnell continues as president of the company, and Mr. Gaylord continues as president of Bell Helicopter Corp., Ft. Worth, Tex.

Leon F. Ebel, board chairman, Fairchild Aircraft Systems, Inc., Los Angeles, Calif. (1954-55) succeeds Mr. Ebel as president.

Henry M. Blythe, president, and Robert A. Bell, executive vice president, Republic Industries Corp., Toledo, Ohio. Mr. Bell also elected president of the company's Industrial Aircraft and Airframe Manufacturing divisions, Columbus, Ohio.

Frank W. Caperton, senior vice president, Pacer, Inc., subsidiary of Pacific Aircraft Corp., Burbank, Calif.

John Tullis, executive vice president, Hamilton, Inc., Ft. Worth, Tex.

Cyril E. McClellan, vice president-engineering, Calhoun-Tribune Industries, Inc., San Francisco, Calif.

Martin F. Burke, vice president-industrial relations, United Aircraft Corp., East Hartford, Conn.

Max Berens, vice president, Vercel Aircraft Co. (Canada), Ltd., Winnipeg, Canada.

William R. Smith and James W. Bolson, stock, vice president, International Business Machines Corp., New York, N. Y.

W. W. Hagg, vice president marketing, North-Central Aircraft, division of Deere Industries, Inc., Moline, Ill.

Dr. G. B. Moulford, director, Aerochemicals, Inc., Bensenville, Calif.

### Honors and Elections

The Royal Aeronautical Society, London, England, has elected the following as vice president of the Council for 1955-56: Air Comdr. F. R. Banks, Air Marshal Sir Owen Jones, and F. S. Moor. F. G. Moulford, managing director of Bristol Aerojets, Ltd., has been elected president-elect of the Society for 1955-56.

Paul Walke, Deputy Director of the Army's Project Whirlwind, has been awarded an honorary Doctor of Engineering degree by Stevens Institute of Technology "for his leading role in the development of micro technology."

### Changes

Thomas Connolly, Jr., chief project engineer, Taurus Aircraft Corp., Idaho, Tex., Paul L. Whitney, assistant, division of Vercel Aircraft Corp., has announced the following changes: Ronald A. Schenck, engineering assistant engine division, Willett & Gorman, assistant engineering manager, Wolford D. Goss, assistant in the engineering manager, Richard T. Burke, chief engine production engineer, Richard A. Goss, chief engine research project (Florida facilities), Walter Dell, assistant chief engine research project (East Hartford facilities), C. T. McKinnon, sales manager, Bert J. McNamee, management and spare parts sales. (Continued on page 100)

## INDUSTRY OBSERVER

Atlas intercontinental ballistic missile incorporates propellant allocation system which employs both main and boosters to such that when booster rocket burns out there is no dead weight remaining.

North American Aviation Missile Development Division's Doo-Don't proposal encompasses unmanned test vehicle and fuel-saturated vehicle. Special group from company's X-15 out-of-atmosphere rocket-astrodynamics project participated in feasibility of proposal.

Manufacture of turbine-electric motor weighing about 30 lbs. is being started in conjunction with Army Ordnance's Martin 88M-642 Lancer nuclear turbine engine. Produced in Propulsion Research Corp. under Los Alamos patent, nuclear-actuator is attached to motor's back to forward position and power generator for communication link to inside firing site. Martin has produced 1,000 Lancer units.

Award of new time contract for Bellite Missile Division's Manned Rocket is scheduled to be made by end of this month. Proposals have been submitted by General Motors Corp., General Electric Co., Douglas Aircraft Co., Aero Research Laboratory, and Pratt & Whitney Co., whose subsidiary, Aerojet Systems Inc., prepared Ford's submission in the bidding.

Now one of intercontinental ballistic missile proved as even better method of inflicting damage during enemy flare had been anticipated in several trials on Army's Jupiter, strengthening the case for using infrared tracking in ballistic missile defense.

Next major Army Modernization Board industry design competition will be for development of test ranging and coordination equipment (TRAC) intended to speed flow and improve control of aircraft movements at the front. AMB briefing for bidders will be held July 8.

Republic Aviation is proposing a modification to convert all of its F-4E and F-4F models now in widespread NATO service to guided missiles with a zero tail fin, a guidance system and provisions for both nuclear and conventional warheads.

Solid propellant producers are showing great deal of interest in also design of aluminum powder being offered by National Research Corp. First evaluation by major missile company reports favorable on material's potential as an energy bearing additive (AN-10, p. 57). Continued to discuss powder state of 7 to 8 micron, dimensions of new aluminum material are guaranteed to be below 0.1 micron and are thought to be much smaller. Eventually straight aluminum, the new powder is not propellant, has a density of 15 lb./cu. ft., and sells for \$35/lb. in five-pound lots.

Ultrasonic method is being considered as effective means to solve difficult problem of determining cracks, discontinuities and other defects in solid propellant rocket motors for ballistic missiles.

Development study has started on small solid-propellant auxiliary power unit with rating equal to 10-15 hp. for hydraulic and electrical services in missiles, at Propulsion Research Corp., Curtiss-Wright subsidiary, Santa Monica, Calif., to produce substantially lower efficiencies than available with well developed turbine.

National Bureau of Standards plans to extend its research in high energy fuels to include ion propulsion. NBS now emphasizes free radical studies.

North American Aviation is considering establishment of space physics laboratory in its missile development division, Dayton, Calif., to strengthen its position in fast-growing field of space technology.

East Martin Titan ICBM is to be delivered to Air Force's main test center at Cape Canaveral will be facilities made for general handling practice at site. Test will be complete, probably will end up being cancelled.



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## Washington Roundup

### Bomb Powered Rocket

Propulsion through the use of a series of controlled nuclear explosions is suggested in a study by General Atomic Division of General Dynamics Corp. has been accepted and funded by the Advanced Research Projects Agency (see box, p. 30). A total of \$1 million has been allocated for a continuation of the study during Fiscal 1959. Further support of the project will depend on the results of this initial phase.

Very large increases in performance are theoretically possible if the explosive force of nuclear fuel can be effectively utilized rather than being mingled with the energy in an ordinary rocket propellant system. Dr. Frederick Hoffman is directing the work which will be centered on San Diego.

### Committee Rule Lessened

Department of Defense last week abolished 137 coordinating committees within the department. Officials said the reduction in committee strength is part of a move to accelerate the decision making process within DOD. An additional 94 committees have been continued to August 1, while further study determines their effectiveness. Another 72 committees are definitely being continued because officials say they are required by statute.

Thus in last week, 299 separate committees composed of representatives of two or more military departments plus civilian experts had a part in Department of Defense activity. The effectiveness of this arrangement was made clear in a Defense Department announcement which said, "Any functions, formerly performed by the 133 committees, that are essential will be assigned to the proper office or agency."

### Space Delay

Staff members of both the House and Senate Space Committees are hopeful that a meeting of the Joint Casework Committee can be scheduled this week to get the final touches to legislation creating a National Space Agency. A meeting of officials has been delayed because of the absence of Sen. Lyndon Johnson (D. Tex.), chairman of the Senate Space Committee.

### Congress: Reliability Study

House Appropriations Subcommittee on Armed Services has begun an investigation of availability of military equipment to determine how the situation in which Defense Department is doing to correct it. In comparison are agreed by recent appropriations hearings testimony, at the request of Rep. George Mahon (D. Tex.). National Bureau of Standards and Anne Rowland Corp. are studying the investigation.

### Contract Changes

Legislation authorizing Defense Department to direct changes in research and production projects without first going through the first-awarding process is completing a new formal contract faces substantial opposition in Congress. Defense Department wants the authority on a permanent basis. Up to now, Congress has granted the authority on a temporary basis. The last authorization expired June 30.

In testimony to House Judiciary Committee urging enactment of the legislation the Aircraft Industries Assn. explained, "The most important but repetitive situations, we consider it essential that the Department of Defense be in a position to take appropriate action when a contractor has been requested to proceed with an urgent program of production, repair, or research. Quite understandably contractors will not agree readily if they know that there is statutory authority for formal action using the emergency route."

Likewise, in the complicated and sometimes hard-to-get procurement which is necessary in these times, military matters are bound to occur. Thus, it seems to us to be fairly appropriate that the Department of Defense have the authority to correct expeditiously such varied situations and now ambiguous which was used."

### Procurement Scrutiny

A move to develop in Congress to require congressional "authorization" of all military procurement programs. At present, only the appropriations to finance the programs are passed by Congress. Under the new proposal, they would first have to be "authorized." This would bring the military procurement programs under congressional committees into the picture, the House and Senate Armed Services Committees as well as the two appropriations committees.

The proposal now put forth by Sen. Francis Case (R. S. D.), a member of the Senate Armed Services Committee and author of the Rescission Act Defense Secretary Neil McMillen presented a study of the proposal. At present all public works programs and Navy's shipbuilding program require congressional "authorization."

### Transportation Tax

Removal of the 10% transportation tax on passengers appears somewhat doubtful during this session of Congress, though Sen. George Mahon (D. Tex.) has proposed to raise a lighter light for freight when technical amendments come up for consideration.

Repeal of the 1% transportation tax on freight, which both houses approved, had somewhat stronger backing than removal of the passenger tax. Railroads strongly oppose the repeal of transportation taxes because more than removal of the freight tax than from allocation of the passenger tax, which would benefit airlines to a great extent.

The Senate earlier approved amendments to the aviation tax bill that would remove both the freight and passenger tax, but Senate House conferees recommended removal of only the 1% freight tax.

### Beverage Bill

There is little likelihood that Congress will take action on the more proposals to prohibit the sale of alcoholic beverages on aircraft before the current session ends. The transportation subcommittee of the Senate Commerce Committee held hearings earlier last week on alcohol beverage laws by the full committee. There has been no action has been taken. The House Commerce Committee has not yet held hearings and chances are that none will be scheduled because of the press of other problems.

—Washington Staff

# Used-Plane Market Faces Critical Era

Low prices and poor business may be the hallmark of market as airlines dump piston planes for jets.

By L. L. Doby

Washington—Airlines and aircraft are destined to become divorced over the prospects for the used-plane market, which is already plagued by an oversupply of aircraft. The market now expected for a prolonged period of slow business marked by slow turn-over and falling prices.

Both airlines and aircraft are the used-plane problem will reach an even more critical level during the next three years when the fastest dump their surplus aircraft into the market to make way for more than 400 turbine-powered planes. Here are the major problems facing both industries as a result of the vast second-hand aircraft market.

•Used plane market for long-range, piston-engine aircraft such as the Douglas DC-7 turbo and the Lockheed 349A soon is virtually nonexistent. Potential customers with sufficient cash or collateral assets are dropping in the marketplace of turbine aircraft and are showing no interest in piston-engine planes.

•Manufacturers are halting or slowing back on the sale of new jet aircraft. They admit, however, that they can be forced to issue to a trade in

order to save time in order to insure a profitable volume of sales. At least ten manufacturers have launched used-plane sales campaigns—Boeing and Convair in hopes of helping potential clients ease cash toward the purchase of jets.

•Most airlines on that reported financing of turbine aircraft was planned without being reference upon proceeds from the sale of piston-engine planes and, therefore, the jet program will not be substantially advanced by a collapse in the used-plane market. The fact remains, however, that the jet line industry is still short of the capital it needs to support the jet program if it is now planned. Probably during the sale of surplus aircraft will help fill this financial gap.

## Obsolescence Problem

In the fast pace of its business, the airline industry is faced with the problem of equipment obsolescence. Unlike a market in turbine aircraft, the factors of obsolescence could force airlines to place their surplus aircraft in a marketplace in preference to finding those markets with an excess of available seat miles. Boeing already has grounded two

Lockheed L-940s, Capital one of the same model, rather than attempt to keep planes in service at a loss. Some airlines feel that this is just the beginning of a systematic pattern since turbine will be forced to live with obsolescence, the oldest transport plane in the market, the DC-3, is the one plane still attracting customers. According to one source, the DC-3 in recent years sold for a typical price of \$43,000 but crashed sharply to as little as a typical price of \$11,000 in 1958.

It is still a marketable airplane, at a relatively high selling price because of a continuing demand for its use as an executive-type airplane and in a remote standby or charter service. An estimated average of 40 turbine transports have been converted each year into executive planes since 1954. Typical conversions include the sale of the DC-3 to backbones of the industry for at least another three years. Never before, and despite its obsolescence, the DC-3 is expected to drop in price to \$75,000 in 1959.

The DC-3's typical price last a high of \$570,000 in 1952, plummeted to \$140,000 in 1954 and then crashed back to as high as \$451,000 in 1956. The going price for the airplane, according to Boeing, has gradually declined since then.

## DC-7 Market

Resale price of the DC-7, but not been put in test in determining when the typical price will ultimately level off. However, American Airlines in a recent statement to the Civil Aeronautics Board predicted that the going price for the DC-7 will eventually drop to as low as \$230,000.

At present a total of 315 DC-7s are in operation or on order by U.S. airlines as of the same time in 1955. In foreign flag carriers, the surplus of the DC-7 will have upon the used-plane market is evidence in place of United Air Lines to retire 36 of its fleet of DC-7s in 1960 and American's program of depreciating its entire fleet of 63 DC-7s by 1961.

American has admitted that, when the DC-7 was originally ordered, it was not expected that the turboprop would be available as early as 1955. The airline also said it has accepted an order to buy the DC-7s it should have for sale.

Capital Airlines has had DC-7s of level it at prices "below \$1 million" but the offer was made "in \$6 million" as an indication of its unwillingness to Capital's requirements. Capital is "looking a state" in disposing of DC-7s, no a sale, lease or lease purchase.

over. The manufacturer is asking a sale price of \$23,000 per month per plane, or a lease rate figure of \$25,000 per month on a five-year lease.

One possible break in the soft DC-7 market may result from plans to use power the DC-7 with Napier-Bland turbo-prop engines. The projected cost savings in operating costs are attractive within the turboprop industry and may open a new market for the long-range aircraft.

## Medium Plane Market

Airlines feel that such medium-range aircraft as the Convair 440 series, the Martin 404, the DC-55 or the Viscount will not pose the same problems that long-range aircraft present.

They emphasize that the high cost of operation and maintenance coupled with an overabundance of operators here, the latter group with a very limited market. As to cost of operation, total direct operating expense of the Convair 440 averages about \$5 cents per plane mile compared to \$1.00 for the DC-7B.

In addition to lower operating costs, the smaller aircraft are easier to operate and easier service in performing a wide variety of airline and charter services. Range of price for used planes in the medium type, piston-engine transport category, remains fairly narrow even by year.

The Convair 440, for example, drew a typical price of \$473,000 in 1952 climbed to \$550,000 in 1954 and then leveled off in an area of approximately \$480,000.

Lack of transportation rules out the DC-4 as a possible product in the marketplace or non-scheduled market. Since military service has ended that aircraft will be limited only to those carriers favoring passenger capacity needs. Independent airlines are hoping to acquire with more modern aircraft. According to the Independent Airlines Assn., member carriers are not interested in the DC-7 because of its high operating and maintenance costs. Whether this will become potential customers for the DC-4B depends upon how much traffic there can be expected to be devoted to them from the Military Air Transport Service schedules. This group's dilemma is that it cannot attract the traffic without aircraft and it cannot buy aircraft until it has the necessary traffic.

## Global Market

According to one private study of the used-plane market, the foreign market for long-range aircraft is also extremely limited. Again, foreign flag carriers with adequate cash and credit are making strong bids to enter jet transport competition and cannot be expected to live with piston-engine trans-



French Build Flying Afor Coleopter

Latest cooperation of the French Beechcraft Flying Afor VTOL (AVR No. 11, p. 37) is based on the Beechcraft Flying Afor. A Beechcraft Flying Afor is shown in flight in the background. The vehicle is scheduled to make its first flight in September. Check out prototype of the Coleopter aircraft.

port themselves from the very aircraft which they want to replace. Some experts on the used-plane field believe that during the next few years the market for manufacturing aircraft in South America will continue strong. This may, however, that price levels may not be expected and that requests for new credit loans will accompany most long-range.

Novel legend potential market for manufacturing equipment is in the Far East. Although the demand for aircraft will be about one-fifth of that in the South American market during the next few years, Central America is now expected to enter the third largest market. Western Europe industrial production of aircraft is very limited market.

During the 1951-1956 period, 252 jet transports were exported from the U.S. Whether the rate can be increased as a means of disposing of surplus planes in the U.S. markets depends in no small degree upon a demand by the Export-Import Bank, with respect to second-hand aircraft.

Although the bank has taken an official stand on the issue, one spokesman suggested privately that the bank might favorably react, even financing an aircraft that has been taken on as evidence by manufacturers of need with a new plane market after some delivery. Chances are strong that the aircraft manufacturing industry, even being the problem directly to the Export-Import Bank, in hopes of gain-

## High-Altitude Sounding Rocket

Washington—Four-stage high-altitude sounding rocket is being pushed to upper limit designed to measure effects of earth-atmosphere rocket tests in connection with Operation Blackout, shortly begun at Edwards, in the Pacific.

Known as Project Jason, the rocket will carry an instrument payload to sound altitudes pattern and other effects, probably achieved in suborbital flights. The rocket will be launched from the Space Force Special Weapons Center, Edwards AFB, CA.

First of the rocket series (NAV No. 7, p. 18), having an altitude capability of 400 to 500 miles is scheduled to be fired twice a week from one of a group of three sites from which a total of at least 30 Jason rockets will be launched to sample Operation Blackout data.

The Jason sounding rocket consists of three solid-propellant, all-stage, air-breathable, and gas-turbine stages.

- First stage—Boost Jet, obtained from Navy Ordnance.
- Second and third stages—Nav Ordnance obtained from Navy Ordnance.
- Fourth stage—Boost Jet.
- Fifth stage—Boost Jet.
- Sixth stage—Boost Jet.

Naval Development Corp., of Pasadena, Calif., is the designer and manufacturer of the Jason rocket package. Navair is scheduled after a test series of the field which included some of the rocket's initial development and testing. First Jason was scheduled to deliver within seven weeks after Navair started the ground segment. Navair also is supplying the launchers—single, vertical "jack" rails that support the rocket from the side of a test house.

Assembly and launching costs for Jason are being supplied and trained by Navair. Lockheed Martin Systems Division, Sunnyvale, Calif., is designer of the instrument package, which weighs approximately 75 lb.

ing the highly needed cockpit voice.

Currently, the U.S. military hopes to use funds from the graduate of turbine equipment (aircraft) through national savings, depreciation and insurance and equipment sales. Extravagant current have progressed (the following through health and maintenance companies and through equity financing.

One private study, conducted to determine the financial needs of the airlines, show that proceeds from the sale of government equipment now seems to be a major factor in the support of jet equipment purchases.

For example, the House indicates that Boeing Airway will require an additional \$400 million more than that already merged if proceeds from the sale of jet equipment total \$5.5 billion in 1980.

Eastern Air Lines, according to the study, will require a total of \$37 million from the sale of equipment to modernize its jet program.

By the Civil Aeronautics Board capital program, the Federal Aviation Authority estimated that equipment purchased during the 1973-1980

period would total \$766,641,000. The report also estimates a similar CAA exhibit that proceeds from equipment refinancing would amount to \$60.5 million after applicable taxes.

According to the study, Pan American will need \$12.5 million in additional financing if its jet program is to be recapitalized. That is, in order for 500 million is an put forward from the sale of post-war aircraft would affect the current aircraft program.

Airline officials, however, are argued that it is impractical and unrealistic to indicate expected proceeds from the sale of equipment in proposed financial planning for jet programs of the private airlines of the cockpit voice.

One airline spokesman said the desire to own private aircraft equipment now sets an introduction, will define rapidly. He predicted that the market value of the average modern aircraft equipment must drop about 32 per cent through 1980. Most airlines indicate that make value of such aircraft will fall to approximately 10% of original value.

Some airlines, however, are arguing in support of government to prevent an increase in price.

## Program for Merger Drafted By Thompson, Ramo-Wooldridge

Los Angeles—Thompson Products and its affiliate, The Ramo-Wooldridge Corp., will merge to become Thompson Ramo-Wooldridge Corp. if stockholders approve the plan. J. D. Wright, president of Thompson Products, said because chairman of the board and chief executive officer of the new corporation.

Dr. Dean Wooldridge and Dr. Simon Ramo, president and senior vice president respectively of Ramo-Wooldridge, will hold the same posts in the new firm. Present Thompson chairman, Paul G. Confield, will head the executive committee.

The merger also follows on the heels of a recent announcement that Ramo-Wooldridge's Space Technology Laboratories had been established as a separate entity. The company, which owned R-W, was Dr. Ramo as president. Space Technology Laboratories holds the technical management contract for Air Force's three cutting ballistic missile programs and is also responsible for the program's technical responsibilities. At USAF's request, for the upcoming Manstein interests: nuclear ballistic missile (see box). Laboratories hold similar responsibilities for USAF's laser guide program.

Anticipated purpose of the merger is to integrate capabilities of two aerospace firms with the objective of expanding

markets and better serving customers in the automotive, missile, aircraft, electronics, nuclear and general industrial fields. Combined company would have 1975 sales estimated at \$180 million, with 1976 sales projected at \$200 million.

Original financial backing for Ramo-Wooldridge was provided by Thompson Products four years ago when the two

### Minuteman Consultant

Los Angeles—Ramo-Wooldridge will serve as technical consultant to the Air Force on its upcoming Manstein interest: nuclear ballistic missile program. The company will be available to the use of plant in USAF's three existing facilities: missile program and laser guide posts.

Advantages of the Manstein system over the liquid fuel missile now being developed were indicated last week in Detroit by Maj. Gen. John W. Senn, Vice Commander of the Air Research and Development Command. Gen. Senn said that the best solution of the air weapons is a solid rocket and that the Air Force interprets that Manstein will be cheaper than a liquid fuel ICBM by a factor of 10. This would indicate that the development part of the Manstein program will cost less than \$100 million.

simultaneous top spots at Hughes Air Corp. and a sharp disagreement with Howard Hughes.

In addition, Thompson Products received 49% of the common stock in Ramo-Wooldridge, the balance went to the two founders, in an additional financing of its jet program is to be recapitalized. That is, in order for 500 million is an put forward from the sale of post-war aircraft would affect the current aircraft program.

When Ramo-Wooldridge acquired Air Force ballistic missile management contract, requiring a major expansion in facilities and personnel, it turned to Thompson Products for additional funds. These were loaned to Ramo-Wooldridge in return for an option which, if exercised, would enable Thompson Products to buy up to 44% interest in the 1961-64 period.

Within the next year, Thompson has remained its Ramo-Wooldridge holdings in another manner—through purchase of stock from Ramo-Wooldridge employees who decided to sell all or part of their holdings. At present, Thompson holds 5719 of the affiliate's stock, plus a controlling interest in the company's wholly owned subsidiary of Ramo-Wooldridge, and the new Space Technology Laboratories, Inc., which became subsidiaries of Air Research Corporation. Air Research Laboratory, a subsidiary of Air Research Laboratories Division that has been renamed Veterans Affairs Laboratory.

Company officials say an immediate effort to integrate Thompson Products and Ramo-Wooldridge is being made in Cleveland, with Ramo-Wooldridge's West Coast operation.

Consolidation of the agreement is subject to certain conditions, including approval by the Federal Reserve Board.

Payment for the interests entered in Ramo-Wooldridge will be by 200,175 shares of common stock in the new corporation, each of which will be in the range of \$100 to \$150. The company also has combined new shares estimated to exceed \$100 million for Ramo-Wooldridge. 1975 sales are projected at \$180 million, with 1976 sales projected at \$200 million.

Of the 1975 Ramo-Wooldridge sales approximately \$10 million will come from production work. The remainder from research and development efforts. There are a number of military contracts which company holds outside Space Technology Laboratories.

Ramo-Wooldridge, which has just received a new research, development and manufacturing building complex, uses Los Angeles International Airport, a facility separate from the build airport's facilities in terms of the buildings of STL, and the ballistic missile of the company. The company is also near Denver. Firm also is seeking a new location in the airport area for future manufacturing facilities.

## More Fiscal 1959 Funds Asked For B-52, KC-135, Hound Dog

By Paul Eastman

Washington—Increased appropriations for B-52, KC-135 jet tankers, North American F-105 and F-4 Phantom II fighters are being requested by the House and Senate for fiscal 1959. The House and Senate are expected to pass the B-52 and F-4 fighter and development during fiscal 1959 was urged last week by Sen. Henry Jackson (D-Wash.), a member of the Senate Armed Services Committee.

Justice, appearing before the Senate Subcommittee on Defense Personnel Appropriations, and he felt the 1959 defense program was deficient in those categories in addition to the programs championed by House senior leader. He said the six programs that will be stronger because of House-created appropriations are:

- **Cost in Army strength** was requested to hold the line at \$1.5 billion.
- **Funds were added to maintain a higher level strength in the Army National Guard and Army Reserve.**
- **Provision was made to increase the modernization of the armed forces.**
- **Funds were provided to increase the number of Polish jet ballistic missile submarines from two to six for a total of nine, and to accelerate the Polish missile program.**
- **Funds were added to accelerate development of Air Force's Minuteman solid-propellant missile system.**

Justice recommended that the subcommittee add \$100 million to the B-52's to the Air Force 1959 fiscal budget to give the U.S. 84 B-52's.

In 1961 instead of the 79 now programmed in the present budget. The Senate and the Senate House in rapid

disagreement that the U.S. lead in manned intercept war, at the current rate, will deteriorate as in the near future.

Justice and the Air Force originally requested \$225 million for fiscal 1959 for the Hound Dog to fully equip the B-52's with the new missile. That, he said, should be possible. House action was urged, he pointed out, to provide extra in needs at \$13.9 million. The House requested the Hound Dog fund request be \$44 million.

The Senate committee also was urged by Jackson to provide funds for the addition of at least 60 KC-135 jet tankers in the budget. That he said would give the Air Force 36 additional KC-135's by November, 1960, rather than the 36 now programmed for the 1959 budget.

By providing funds now instead of later, Jackson estimated that the Air Force would save \$100 million in 1972-73 (which is the 1972-73 budget) to \$12.24 million for the 16 KC-135's, for the 84 B-52's, he said, the savings would be about \$13,776 million.

Jackson pointed out that the present program calls for a program of two tankers to every four B-52's, which will not be achieved until 1961. He added that the only operational jet tanker in prospect to rival Conquest's B-52's would be the KC-135, but that since the new tanker requires further support on a one-to-one ratio, either more tankers will have to be built as a portion of tankers must be diverted from the B-52's.

Jackson urged the committee to make both increases both in the service men and air equipment both in and in the Defense Department's program fund. He said not enough

funds are being provided to assure the support effort required for annual new weapons programs. He said:

"This country is engaged in a series of tests of discovery with the Soviet Union. Some of these tests involve highly-advanced projects—so that failure to be first in their completion means a serious demoralization in our military and political position. We therefore must insure that that critical program do not suffer from lack of funds."

"This means that adequate support must be given to important research and development projects now made over in the three services. This also means that the House and Senate must be urged to take action to take advantage of modern technology."

Jackson told the committee that in the next few months perhaps back through as much as such fields as solid propellant, airframe systems, airframe, computer techniques, modernized air component developments, as well as in basic research.

He said the \$2.7 billion provided by the House for the development of the \$190 million for the new program fund, together with authority to transfer \$100 million, was inadequate and that serious consideration should be given to providing extra funds.

## Northern Radar Cost Set at \$400 Million

Bellevue—Building and installation of ballistic missile early warning system (BMEWS) radar at two sites in far north is expected to cost \$400 million, said a report from the cost of constructing the DEW Line in the Arctic, with \$1.5 billion in total.

First figures on the total cost of BMEWS, and the exact number of radars stations in the DEW Line, were released by Defense Secretary Dean Rusk. He said that the cost of the DEW Line in the Arctic, with \$1.5 billion in total.

One of the most serious examples of the growing cost and complexity of defense electronics.

- **Defense electronics development and production** is expected to total \$4 billion in 1959, compared to about \$750 million in 1957.
- **F-106** for control navigation system, being developed by Hughes Aircraft, has cost over \$100 million. "Five years ago a development cost of \$10 million for an electronic five-day system of defense had been considered reasonable," Quares said.
- **B-58** bombing-capable cruise missile, development, and delivery of first test items, is costing over \$100 million and requiring resources of \$200 million for engineering effort, Quares said. System is being developed by Aerojet Corporation.

## Germans Study Mirage III in Paris

Paris—Top level German delegates led by Defense Minister Franz Josef Strauss in Paris this week for a first look at the Dassault Mirage III interceptor before making a final choice of a Luftwaffe fighter.

Despite previous reports in European aviation circles that the Germans intend to select the Lockheed F-104 Starfighter, Dassault still hopes to get some German orders for its Mirage III. The Strauss mission, while attending to German Government defense matters in Paris, is nevertheless expected to devote a good portion of its time to studying the Mirage program.

The Germans are reportedly still enthusiastic about the French interceptors but feel an aircraft is not as sophisticated as the Starfighter.

A Dassault spokesman, despite well-publicized reports to the contrary, strongly denied that a German pilot had previously severely damaged a Mirage III during last week's maneuvers.

What happened, according to Dassault, is that a test on the Mirage III pilot-type pilot who crashed a test landing and that some damage to the landing gear resulted. No emergency system in Paris and about said the damage was considerably damaged and that a crash, without any real reason.

In any case, in addition to the Mirage III prototype, Dassault is now flying a Mirage III's production model and expects to fly a second prototype in September.







ITALIAN "Red Devils" aerobatic team announces subject at final in team formation maneuvers. Three of its aircraft are shown here.



AFTERBURNERS on, McDonnell F-101 and Lockheed F-104B make contact maneuver as part of Eagle air show (above and below).



PLANNED by 12 North American F-100 jet fighters, four Douglas F-4B two-by-two formation four circles of this Eagle fly.



SKYBLAZER aerobatic team, flying F-100s, makes a post-flight maneuver which was designed to be a surprise.



U.S. NAVY pilots make low pass in tail formation. Shows, four by four Douglas A-1H McDonnell F-101 North American T-4 and Douglas A-4.

# First SAGE Direction Center Operating

By James A. Faus

McGuire AFB—An F-105 has accepted and played in operation the first Direction Center of its kind—Atlantic General Surveillance (SAGE) system at McGuire Air Force Base, Trenton, N. J., to direct the operation of the New York Air Defense Sector. SAGE system is designed to support the capacity and effectiveness of the U.S. air defense system by substituting highly automatic data processing equipment for the manual plotting and interception in the system.

- Acceptance and completion of target information from seven types of detection and tracking radars.
- Identification of aircraft following the system either by flight plan correlation or visual identification.
- Detection of employment of defense weapons to prevent penetration of the system by hostile aircraft (armed or unarmed).

## System's Effectiveness

Present capabilities of the SAGE system is for defense against piloted air craft and cruise missiles that are not radar-invisible ballistic missiles. The system's proposed weapons, post

ed that the time Soviet forces, at least for the next two years, will be from missile launchers.

Additionally, SAGE installations are used to be capable of modification and improvement as new types of equipment are developed. For example, defense against subsonic ballistic missiles would require additional radars with much greater range, resolution and tracking speeds to supply target data to the system, an expanded and refined SAGE computer, a separate anti-missile computer and new anti-missile weapons to carry out intercepts.

In the fall of 1961, the Air Force plans to have 25 SAGE system in operation covering the entire U.S. Additionally, Canada is to have a similar system as part of the joint U.S.-Canada air defense effort.

In the event of an air attack, defense components of all three sectors within an air defense sector come under the operational control of a Continental Air Defense (CONAD) commander, including Air Force interceptors and Reserve component Air mobile fighters, and assigned Navy and reserve units.

## Sector Coordination

SAGE system will include facilities for coordinating information about the air battle by allowing status and to a Control Center, which coordinates actions within a group of air defense sectors. New York Air Defense Sector, for example, will be tied into a Control Center located in Trenton, N. J., due to become operational in September. From this Control Center, the defense of the northeastern U.S. will be coordinated.

SAGE system benefits in a network of interconnected direction centers equipped with large digital computers that receive report information relating to the detection and identification of means aircraft and provides report information in the form of battle orders to defense weapons.

The digitized AN/FSQ-7 digital computer installed in each direction center is used by information systems. McGuire Corp., the manufacturer, to be the largest and fastest computer in the world, capable of performing 65,000 computations per second. It is designed so that one unit can be out of service for maintenance or repair while the other unit is in operation.

Target data reports to the computer originate at radar sites within the sector or at cross-link data processing centers. Within the sector, the first SAGE system will use such radars in Beale Air-

ton Corp.'s AN/FPS-20 long range surveillance radar and AN/FPS-14 gap filler radar.

At this radar site, the raw radar data is converted by Remington Corp. AN/FPS-14 to a data processing report to the third radar site which is transmitted over standard telephone lines to the direction center where target coordinates are entered into the computer and displayed.

## Four Types of Data

In general, the data fed into the computer is of four types:

- Long range radar. Range, bearing and elevation information are detected and each is received from heavy ground radar and height finders. These lower radar radar data and airborne early warning aircraft.

• Gap filler radar. Functions data on aircraft received from the long range

radar by human intercept or earth's curvature is transmitted to the computer from medium range gap filler radar.

- Cruise-fighter equipment. At fixed stations in one sector can be transmitted to or requested from an adjoining sector's computer to provide a composite picture. Identification of friendly aircraft entering a sector would be coordinated from the adjacent sector.

• Manual input equipment. Data can be entered into the computer or obtained from it in terms of each equipment or personnel needs, manual key boards, printers and microfilm.

Computer stores previously received information in its memory banks. As new data is received the computer compares it with stored data and is directed by an operator, computer operator program performs the necessary computations to project target

track, data sources and calculates the attack threat in terms of the deployment and speed of available defense weapons and displays this data so that operators can manage and direct weapons on the basis of continuously current air battle information.

## Data Links System

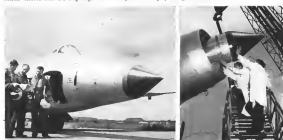
At a fixed data link cell for a further step in automatic data handling with the installation of General Electric AN/GKA-4 Flight Control Group, voice link, known as a data link system. In use, a station in formation generated by the SAGE system will be connected for transmission by UHF radio directly to assigned intercept or ground-to-air intercept when necessary equipment will intercept the data into information sent to the intercept computer or missile guidance system.



VISUAL display of air situation is processed for staff analysis and command decisions in the SAGE control center room. Display is generated by AN/FSQ-7 SAGE computer system.



FIELD engineers use AN/FSQ-7 SAGE computer system units. Console shows the operating status of system's electronic equipment to ensure instant maintenance in event of failure. Digital computer also is displayed in another photograph.



Airframe and fire control system is tested on English Electric Canberra at left, after new system installation to contain control body of P-1B. At right, maintenance staff load the control body in specially built nose section of Douglas D-18 transport.

## P.1B Shock Inlet Houses Radar, Airborne Fire Control System

Bea—Center body of English Electric P.1B system, made, contains new airborne radar and fire control system designed to support and demonstrate use in West German Air Force.

Need for more radar in more positions led to design of circular angle shock inlet with center body (AN/FSQ-10, 1957), following extensive testing of P.1B prototype. Radar details were not previously revealed.

At present, development for airborne interception radar and pilot attack sight

system, was demonstrated by Farnborough, in view of the vast development program. Company shows system is one of the most advanced now used. Made of two basic units, radar and sighting, Arpa looks onto target through a wide angle sighting system.

Arpa housing in P.1B control body does not increase frontal area and at same time provides a good shock wave shape, officials said. Promote design for interception attack without visual

contact, system also incorporates visual sighting capability.

Range and speed information are fed to the sighting unit. A computer then calculates time and displays this to the pilot.

Automatic sighting system informs the pilot on bank, off attack if he is heading to overtake the target.

Arpa's flight trials were first made in Douglas Dakota and then later in a Canberra modified to produce conditions as near as possible to those in the P.1B.

Enough speed and Arpa in "small enough and light enough to be installed even in a lightweight fighter" such as the Folland Gnat.



## CAB Probes Viscount, T-33 Collision

Obsolescence of air traffic control radar system emphasized as Board begins hearings on accident.

By Robert H. Cook

Washington—Obsolescence of radar in traffic control used by both airlines and work of a light landing panel at the Civil Aeronautics Board investigating the Jan. 28 collision of a Capital Airlines Viscount and a Naval Air T-33 jet trainer (AW No. 28 p. 15).

The accident near Brunswick, Md., claimed the lives of 13 persons aboard the airliner and a passenger in the T-33 trainer which was piloted by Air National Guard Capt. John McCoo who perished in action.

Extensive accounts from students of the area, were in general agreement that the two aircraft were headed west when the T-33 attacked the Viscount and made a sharp right turn into the nose section of the airliner. McCoo, however, said that neither he nor his passenger, National Guard Pfc. Donald A. Chalmers, saw anything in the vicinity. He said the two aircraft were close but he had been "blown from the plane" by an explosion.

Radar controllers at Washington National Airport spotted the two planes seconds before the collision but the usage and reception of that signal, Air Force radar equipment failed to project the picture clearly enough to permit the possible collision.

### Continental Probe

Controller Charles A. Luzzano, who was watching an area between Martinsburg, W. Va., and Baltimore, testified that he had spotted Capital's flight 500 and granted the pilot permission to descend to and maintain 7,000 ft. at Martinsburg. He then said he believed one controller, Charles A. Hauld, to release him for a few moments. When his release Hauld pointed out the Capital flight and said he had given a clearance for the Viscount to descend to 5,000 ft. over Sugar Land Mountain in an approach to Baltimore's Friendship International Airport.

Both controllers allowed the flight for a full minute during which time neither saw any other traffic in the area. Seconds after Hauld returned to his position, Luzzano spotted a third return of another larger and, on the second view of the radar screen, the target seemed to disappear while the

Viscount was

As he attempted to contact the flight to determine its altitude in order to advise of possible VFR traffic, the radar plot expanded to cover an area of north, then south, he said. The picture centered about Martinsburg on the radar screen for one and a half minutes before fading.

The controller said a post-flight check of radar and other navigational aids in the area showed the equipment to be operating properly but that he continued to call until notified of the accident. He added that just prior to the ship enlargement the two aircraft appeared to be one quarter of a mile apart.

Charles W. Connors, assistant director of the CAB's Office of Air Traffic Control, identified the radar as one as surplus MIFW Air Force equipment, providing a high and low beam with a searching range of 20 to 40 miles. Range of the low beam used for monitoring traffic from the west is about 16 mi. On this installation, which he termed obsolete, will be replaced by, Sept. 1, 1957, a new long-range radar having twice the range of present equipment.

### New TWA President

Los Angeles—Former Secretary of the Navy, Charles S. Thomas, was elected president and a director of Trans World Airlines last week according to Walter Lee Pearson who has served as interim president since the resignation of the top official last last week (AW No. 6 p. 4).

Thomas was named New Secretary in 1954 and served in that position for three years. During World War II he served as naval assistant to Navy Secretary James Forrestal and was in charge of all procurement of naval aircraft.

From 1947 to 1952 he was president of Trans World Airlines, a major shipping agent. In 1951 he was appointed Chief Secretary of Navy and later that year he was named to the newly-created office of Assistant Secretary of Defense for Supply and Logistics.

Thomas will take over his new duties immediately at TWA's New York head quarters.

He told the panel, however, that while the same procedure may be used to produce a better radar picture, it will be subject to limitations in selection to be able to return signals from jet aircraft. Connors explained that the revolving parabolic pattern of parabolic radar makes "confusing" signals for radar beams. The absence of such patterns from jet aircraft causes a target much more difficult to detect on a radar screen.

Most military jet aircraft handled in air traffic controllers are equipped with radar beacon transponders which are used under emergency and provide speed and altitude identification by positive code.

A study of the wreckage in CAB investigations indicated that the angle of collision between the aircraft was 45 degrees horizontal with evidence that the Viscount was struck from the rear. The assistance, John F. Pohl, acting chief of the CAB's Structures Group in the investigation, said the T-33's vertical angle had not yet been determined.

### Impact Area

Pohl and the night wing pad of the jet struck the Viscount between the number two engine and a piece in the immediate rear of the cockpit.

Neither number one nor two engine props have any evidence of damage due to collision in comparison with ship used tests on the simulated propeller. While the investigator stated that the findings of his group have not been fully analyzed, representatives of the TWA, Pohl, Connors and Capital said they lack the lack of evidence required to point out propellers as a clear indication that the jet, not the Viscount, was the cause while changing and then broke into the Viscount.

McCoo explained that he had taken Pfc. Chalmers aboard his subsonic trainer flight in the hope of introducing him in flight training. Flight VFR in clear weather conditions, he said he, recorded from 4,000 to 5,000 ft. to cable Chalmers to map portions of the "cross country side" he said he had been made to 9,000 ft. with a descent in the Baltimore area. He added that all birds were kept to less than 30 degrees for the conduct of his program.

McCoo was unable to recall his speed as rate of climb at the time of the accident but estimated his power setting

at 85%. He said his only recollection of trouble was "an explosion" and the aircraft "bumping around." The pilot added his first view of the collision was told him in the hospital.

### Pilot's Record

In answer to panel members' questions McCoo testified he had 1,000 flying hours accumulated since 1944. Of this total, 600 are in jets including 250 hours in the T-33 in which he has served as instructor for the 104th Lighter Interceptor Squadron of the Maryland Air National Guard.

Although he flew the jet a few days before the accident, McCoo recalls that prior to that it had been 30 days since he had flight. Maximum periods between flights adopted by the 104th is 60 days.

McCoo explained that, since his unit's standards were more strict than those of the Air Force, "we have a ten times amount of instruction."

Capital Airlines attorneys called for Air Force records which they said show that McCoo had two previous flight accidents. While the National Guard pilot at first declined to furnish on details on the grounds that given aircraft had not been on the Bureau's records and were also classified documents held by the Air Force, he gave a full account on the last day of the hearing.

In the fall of 1945 he said that while observing a gunners range practice he was firing behind a two plane in a training area when a fellow pilot "made a pass" and the two P-46s collided.

The other pilot bailed out, McCoo successfully bailed his aircraft.

Four months later, the night wing of his P-46, the last aircraft of another squadron during maneuvers of a three-plane formation. Again, he said, the pilot of the other plane parachuted to safety while McCoo landed.

CAR Vice Chairman, Clara Connor, who headed the panel, asked the hearing with a reminder that one new evidence would be grounds for a suspension of the investigation.

### Competing Airlines Distribute Services

New York—Three European airlines have entered into a cooperative scheduled air arrangement on the South Atlantic route to provide an even distribution of service throughout the week. Air France, Alitalia and Lufthansa have negotiated these regular South Atlantic frequencies to avoid duplication of most schedules.

Under the arrangement, Air France's Super G Caravelles leave Paris on Tuesday, Thursday and Sunday for



Convair 440 Wing Is Completed

First wing for Convair 440 jet transport is hoisted from one of its wings was recently taken at company's San Diego, Calif., plant. Second wing is on right hangarway. Next step is taking in elevator over to engine integral built tanks by handwork method. Transport's wing has 120 ft. span and one of 1,200 sq. ft. Bomb-layers will be used into single wing next month. Assembly is under way on Convair's first four jet transports.

South American destinations. Left hand is Super G line in hangar on Monday, Wednesday and Saturday, and Alitalia's DC-8s leave Rome on Thursday and Sunday. All services are in mixed configurations.

The South Atlantic flights are making schedules, for example, Air France's Thursday departure from Paris stops at Madrid, Dakar, Rio de Janeiro, Sao Paulo, Montevideo, and Buenos Aires.

### Air France, Acroflot To Fly Moscow-Paris

Paris—Air France last month will begin serving Moscow from Paris on a bi-weekly basis using Super G Caravelles. Under a bilateral agreement between France and the Soviet Union, the Russian carrier, Aeroflot, will start its bi-weekly service at the same time as Air France using Tu-104s, jetliners. Both carriers agreed to offer flights on a mixed basis with first and tourist class seats. Air France and Aeroflot must fulfill certain agreements between the Russian carrier and British European Airways, KLM Royal Dutch Airlines and Sabena.

Prior to these agreements, the only western carrier permitted to visit Moscow was Pan Am and SAS.

Paris assembly circles also report that Aeroflot officials indicated, while here, that the Russian carrier may soon apply for IATA membership.

### Senate Unit Urges Transport Survey

Washington—Senate Commerce Committee is asking for \$100,000 to begin an extensive study of transportation systems within the U.S.

Sen. Warren Magnuson (D-Wash.) the committee chairman, said these points will be covered in the study:

1. "The need for regulations of transport taken under present-day conditions and those to be used for regulations, the type and character of that regulation."

2. "The use of federal policy dealing with government assistance provided the various forms of transportation and the desirability of a system of costs charges to be assessed against those using such facilities."

3. "The subject of the ownership of one form of transportation by another. Such ownership, except in special cases, is generally either forbidden or made extremely difficult under existing statutes."

4. "Federal promotional policy in regard to various forms of transportation."

The Senate Rules Committee has approved the partial \$100,000 request. Magnuson said that "it will no doubt be necessary at a later date, to require a substantial additional amount of money to continue and complete the vital project." He said that a staff of experts would make reports to the committee on key aspects of the transportation picture a three 11 months.

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lems of design, testing and quality control presented themselves. However, 23 years of experience proved of assistance. As a result, a new standard has thus been set by which all previous switches must be measured.

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## Vanguard Turboprop Transport Nears Completion

First Viking-Aerostar (Aerostar) Ltd. turboprop Vanguard transport is shown as final assembly line at Weybridge, England. First-look production aircraft, which will include all variants, is expected to enter first flight this fall. Its development is the first of 13 Vanguard ordered by British European Airways (BAE Sept. 3 p. 70). Almost all airborne components of the first Vanguard have been fabricated and most have been fitted. Systems testing and installation is almost completed. Assembly tests will begin in about a month. Front and rear passenger compartments of Vanguard No. 1 are being fitted with BA's furnishings. Rest of passenger cabin will contain observation and sleeping equipment which is being pre-assembled on a false floor, a partition designed to simplify installation.

## Electra Performance Evaluated in Mexico

Mexico City-Lockheed Aircraft Co. and Eastern Air Lines test crew brought Lockheed's first production model of the turboprop Electra here for high altitude landing and takeoff tests at International Airport.

Tests were made after a week of an intensive testing tour of the United States, which included Electra's first non-stop flight from Burbank, Calif., to Mexico City, a flight time of 6 hr. 15 min. including 18 min. traffic delay in Mexico City.

Lockheed flew the Electra to Mexico City for several days of tests for the Navy which will use it as an intermediate range aircraft.

Electra will get 40 Electra and plans to put some of them on its Mexico City-New York non-stop route next year. Aerostar de Mexico also plans to buy three Electra and Compañia Mexicana de Aviación is interested in the aircraft.

Tests were under supervision of Herman Schom, Lockheed's chief engineering test pilot. Test program included operations from Lockheed, Western Airline Division and General Motors Allison Division programs.

Engineers said the Electra did better than was expected on takeoff power at

the high altitude (7,500 ft.) and no down to high temperature. They added that the Electra averaged 2,900 chp on takeoff; it was only expected to develop 2,500 to 2,600 chp.

Electra arrived from Indianapolis, flight time was 4 hr., 55 min. (which included sleeping time) before reaching just inside Mexico's border.

Electra officials said that expected flight time from New York to Mexico City with Electra will be about five hours.

Crew reported that International Airport runway was much better than they expected.

The Electra picked up considerable tailspin after which it came around. Filled checkbook (the crew) and ground crew.

For demonstration purposes, landing was made on a test of speed. 1,000 ft. with ground air gusts on the propellers and very little reverse thrust.

A simulated water-land was made at Mexico City's high altitude strip with which about landing at 110 ft. landing speed. Similar tests were made at Angeles on the Pacific Ocean (see below). Maximum landing load for Mexico City was estimated at 95,000 lb.

Test loads averaged 74,000 lb. Test inflight loads were made at 78,000 lb. gross weight. Maximum gross weight at sea level is 111,000 lb.

## Air Transport Assn. Scored on High Fares

Washington-Senate Small Business Committee's Chairman, Sen. John Sparkman (D-Ala.) charged in a floor speech that the air transport industry "is on its way to creating its own man-made depression" with high fares which will not help volume business.

"As such of the new, volume-owned, positive independent carrier and launched in the new carrier market which they pioneered, it was naturally, provided by Civil Aeronautics Board (CAB) action. Sparkman pointed out that competition was the origin of the new air transport industry and that region was cut off in the turboprop program initiated by both the major airlines and the CAB itself."

He and the Board's success, according to a 60% across-the-board fare increase because "the industry was terrible."

"Scared off from competition, the big airlines" demand for a fare increase on the "cheap" next stop," the Senate said.

Sparkman urged CAB to "protect the aviation companies from their own domestic market." He said, "Dealing the air transport, 'fleece' will hurt the University of the industry, planning, no doubt, that their own plane jobs are a national defense asset."



## Feats of Hercules No. 5

### FROM THE SNOWS OF FUJIYAMA TO THE SANDS OF FLORIDA

The Lockheed C-130 Hercules, now in service with the United States Air Force at Alcala Air Base, Japan, now in "go anywhere, land anything" operation the hard way.

In snow landing and take-off runs at Sasebo, Missouri, the "Go-130" Hercules performed prodigious feats of strength and power. An 114,000-pound gross take-off weight the do-or-die Hercules was airborne in 2,100 feet. Carrying the same payload it landed and stopped in only 1,200 feet.

At Eglin Air Force Base, Florida, the

C-130 Hercules (weighing 120,000 pounds) landed on sand and stopped in 947 feet. Take-off from sand, with the same load, averaged only 2,200 feet.

The famous aerial "ironhorse" can carry 95% of all types of supplies now operational with, and under development for, the U.S. Armed Forces. The C-130 Hercules is now a world-wide service, as scheduled for delivery to USAF's Tactical Air Command, U.S. Air Force, Pacific Air Force, Air Force and Marine Corps, other branches of the U.S. Armed Forces, and the Royal Australian Air Force.



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## SHORTLINES

▶ **Vladivostok**, the natural harbor of India, has announced it will accept new service from New York to Karachi and Bombay via Rome on Nov. 1, 1958. The new flight will be operated twice weekly in each direction with one flight operating Rome-Alexandria-Bombay and the other Rome-Tokyo-Karachi-Bombay. Douglas DC-7C aircraft will fly the New York-Rome segment with Douglas DC-6B aircraft operating from Rome to the Asian cities. Considerable first class tourist and economy class seating arrangements will be made. Air India also plans service to Japan and Australia next year and is negotiating for additional service at specific U.S. ports.

▶ **Douglas Aircraft Co.** has delivered its 1,000th order of the DC-6 and DC-7 series. The latest DC-7, now destined for United Air Lines, is the 77th such plane delivered to the airline and the 151st DC-6 and 7 series aircraft placed in service by United.

▶ **Eastern Air Lines** has awarded seven contracts for 17,400,000 gal. of fuel to run its fleet of turboprop and turboshaft the next three years. The seven oil companies are: Cities Service, Petroleum One Standard Oil, Gulf Oil, Shell Oil, Sinclair Refining, Standard Oil of Ohio and The Texas Co.

▶ **Flying Tiger Line** has been awarded a three-month \$1 million contract by the Military Air Transport Service to be its prime contractor on Pacific operations. The contract calls for passenger and freight service between the U.S. mainland and various points in the Far East, chiefly Tokyo.

▶ **Jettable Airlines** has its sixth schedule of 25 flights during June between the U.S. and Europe operated with a 100% passenger payload. The airline also announced that passenger loads on transatlantic flights for the first five months of 1958 were 42% higher than the same period last year.

▶ **Pan American World Airways** has announced the award of a contract for the construction of its 51 million terminal at New York International Airport to the Turner Construction Co. of New York. The airline work will start immediately and will be completed sometime in the fall of 1959. Pan Am also announced it has 1,360,000 lb. of cargo scheduled from the U.S. to Europe in the last four months of 1958, an 18% increase over the same period last year.

## AIRLINE OBSERVER

▶ **Airlines** continue stock prices, which continue to show strength in holding close to 1958 highs, are viewed by many brokers as "disagree" in the light of disappointing news that second quarter results were down as signs of recession from the current traffic slump. However, a number of brokers feel that even the slow-based characteristics of financial markets by some carriers will not discourage investors who are looking for the growth factor of these companies about to introduce jet transport.

▶ **Domestic airlines** are now convinced that the current traffic slump coupled with the uncertainty of jets and a resulting increase in available seat miles is closely uniting scheduled passenger lines in the general passenger fare investigation. Brokers from the Civil Aeronautics Board will be required to rest its decision early and cite on facts that will no longer be relevant because of the rapidly changing face of air travel.

▶ **Roma** expects to increase the payload of its new jet and turboprop transports to as much as 1,000 lb. through the use of such-developed lighter body-weighing materials. Replacement of former material with "airframe" glass fiber will cut the weight of a trim 747 by 800-1,100 lb. according to Soviet reports. Weight of the turboprop 1138 will be reduced by 11,000 lb. in the substitution. 1138 units of the alloy has lost one 1-2 inches in diameter and an even lighter "superior" will soon be made available to Soviet aircraft builders.

▶ **Agreement** between scheduled airlines and Military Traffic Management Agency to continue the 10% discount for military transportation through June 30, 1959, has been approved by the Civil Aeronautics Board. However, the Board reserved the right to eliminate the discount clause if the present investigation of military tariffs and agreements with the airlines show that the discount is not in the public interest.

▶ **Military services** have agreed to defer a full required equipment of main armament of all ICR aircraft and aircraft below 10,000 ft. on all military aircraft. Civil Aeronautics Administration, admitting that such a practice would provide a greater degree of protection for all users of the airspace, emphasized that the increased demand for ICR services would overload present air traffic control capacity. Therefore, the CAA asked the military services to consider ICR operations to various and in controlled airspace between 10,000 and 20,000 ft.

▶ **Increase in available seat miles** offered by domestic airlines continued to level off during May. Available seat miles produced in May totaled 3.49 billion, a 5% increase over the same month last year. In May 1957, increase was 17.9%. Percent of increase in available seat miles for the year ending May, 1958, was the lowest since November, 1956.

▶ **Caribbean Airways** has begun delivery of a large number of two-engine Super Aero-45 light transports ordered by Roma's state-owned airline, Aeroflot. The planes powered by 165-hp. Walter Mewer 6111 engines, carry a pilot and six passengers. Some reports state Aeroflot aircraft are now being checked out to the first two of the Super Aero-45 received by the Russian carrier.

▶ **Chicago Helicopter Airways** has asked the Civil Aeronautics Board for a temporary seat increase for the period April 6, 1958 to March 15, 1959. The carrier is asking for the increase to cover broken-down and interest charges incurred from loss for the purchase of equipment.

▶ **Congressional legislation** growing statewide in Alaska is not likely to bring about any major changes in the status of Alaskan airlines. Civil Aeronautics Board is now studying legal aspects involved but most observers feel that, aside of redesigning the carrier from a territorial region to a local service close the carrier will continue to operate as they do now.

▶ **Hearings** on proposed Federal Aviation Agency were concluded by House Commerce Transportation Subcommittee last week. Bill is expected to be reported out by the Commerce Committee without undergoing any serious that would result in substantial differences from the Senate companion bill.

### Airline Income & Expenses-First Quarter 1958

	Percentage Revenue	U.S. Mail <sup>1</sup>	Priority	Cherish	Product Subsidiary	Total Operating Expenses	Total Operating Expenses	Net Income (Before Taxes)
<b>DOMESTIC TRUCK</b>								
American	41,265,440	1,630,842	5,614,377	31,370		48,500,839	47,944,076	3,996,761
Sealed	12,019,444	389,264	673,728	11,111		13,093,553	13,021,351	730,727
Capital	32,246,000	1,241,578	4,940,649	20,259		38,458,486	36,922,725	3,154,110
Cardinal	5,102,001	134,444	381,393	3,360		5,618,200	5,576,208	501,992
State	776,840	440,977	1,291,140	32,171		2,509,058	2,364,346	1,344,712
Truck	41,265,440	2,001,164	8,059,137	64,917		51,389,758	50,315,486	4,143,602
Horizontal	15,800,974	353,526	638,126	45,853		17,038,629	16,833,747	172,881
National	5,309,736	110,245	331,299	17,936		6,061,215	5,877,001	463,228
Other	446,762	11,384	21,373	17,239		502,556	489,363	4,293,446
Trans World	4,733,726	110,178	2,364,710	74,740		6,279,354	6,026,372	4,408,979
Truck	31,116,719	1,389,419	4,844,220	2,293		37,352,658	36,444,813	1,737,845
Vehicle <sup>2</sup>	4,733,726	110,178	2,364,710	74,740		7,283,354	6,955,161	13,388

[illegible]

LÖHNSUMMEN									
Aktienkurs	1.344,706	90,403	49.703	1.678	214,023	1.370,140	2.189,250	-495,491	
Börsumme	661,154	1.187	28.761	888	999,666	1.640,616	1.161,123	288,893	
Stammakt	2.726,272	6.971	228.207	1.012	228.207	228.207	148.207	83.400	
Bonusakt	844,193	109	40.004	10.201	201.505	1.679,472	1.738,154	-458,682	
Unter Capital	423,289	12.000	16.136	14.887	444,844	967,964	936,970	-37,006	
Neubau	12,273,244	12.000	18.187	14.887	444,844	967,964	936,970	-37,006	
Neubau	2.644,102	55,113	42,668	40,374	604,023	3.608,036	3.705,551	-97,515	
Gesamt	1.021,102	28,207	47,001	18,889	368,001	1.604,174	1.167,704	-436,470	
Passive	1.662,267	28,204	25,254	25,254	12,625	1.662,267	1.662,267	-	
Passive	94,411	94,411	94,411	94,411	13,567	473,071	473,071	-	
Investition	261,569	15,101	105,145	3,061	425,113	110,797	393,193	-116,844	
Interne Transf.	777,123	10,119	10,119	10,119	10,119	10,119	10,119	-	
Interne Transf.	654,112	12,723	17,723	17,723	478,111	1.161,481	964,101	-207,381	

<b>NEWMAN</b>							
Newman	917,702	8,549	110,391	1,547	1,013,216	1,238,294	-246,048
Trans-Perlite	319,379	1,888	29,817	440	491,198	448,887	-19,212
<b>CARGO UNIT</b>							
Canadian National American			374,113	64,511	438,726	438,726	-15,808

Flying Time	10,021	2,403,817	4,424,828	4,876,185	7,454,975	493,347
Enroute	16,494	1,061,246	1,388,120	2,340,730	3,772,190	— 379,152
Reduced & Western? Miles	16,442	481,177	617,169	1,361,491	2,550,947	— 327,420

MULTICARRIER LOSS								
Chicago-Houston	100,434	13,458	5,177		292,991	408,260	446,371	- 25,887
Los Angeles-San Diego	37,312	20,100	11,199	714	324,168	248,838	280,255	35,166
New York-Albany	113,317	16,748	10,602	4,324	393,373	346,191	375,730	- 45,179

ALBINA (MDS)									
Albino (MDS)	227,706	114,907	168,420	207,747	323,723	1,378,188	1,596,664	-3,176	
Albino (MDS)	123,820	32,140	31,493	1,064	81,862	344,267	326,621	-78,544	
Concordance	91.913	82.123	9.208	17.970	91.863	95.965	94.118	0.265	
Wt	79,430	17,470	11,770	3,481	48,207	117,856	134,847	-5,489	
Marfanoid (MDS)	416,420	42,710	3,681	2,881	17,391	1,047,463	1,163,163	-115,699	
Marfanoid (MDS)	416,420	42,710	3,681	2,881	17,391	1,047,463	1,163,163	-115,699	
Score	153,291	79,440	55,563	60,719	240,420	262,740	17,319	-145,421	
Wt (MDS)	133,176	11,463	21,652	162,240	355,391	736,760	841,767	-105,007	

\* Not available. \*\* Western States 2/20/88-3/1/88. † Alaska Coastal Partnership—no longer covered by ADVENTURE WORLD from all five reports to the Civilian Research Board.

**Hydrex: Modelling & Control Always!**

**GROUND** traffic at N.Y. International Airport is controlled by Airport Surface Detect Equipment under new radar resolution. Three aircraft are seen waiting in island slots (one forest center), one aircraft has landed (lower left) and a being taxied off the runway.

## Idlewild Radar Surveys Taxiways

New York—Ground traffic at New York International Airport is under investigation by its improved Airport Surface Detection Equipment radar recently installed in J.F.K.'s control tower by Civil Aeronautics Administration men and engineers.

The narrow-beam 'line raster' provides a high-contrast picture on its stage to give excellent on-axis focus and sharpness in its most recent stills, and two-angled planes of light distinguished from four-angled types.

[illegible]

The Midwest ASME antenna mounted at the top of the 187 ft tower and enclosed in a polystyrene control, inflated dome has been

0.25 deg. in width, which the same lattice can be the narrowest beam used to any present radio frequency, is 24,000 mc.

High-power beamwidth of the high-resolution radar is 15 ft at 3,000 ft from the antenna and physical length of the pulse is 13 ft. At the same distance, the ASR-3 surveillance radar's respective dimensions are 385 ft by 71 ft.

## SAS Picks Up Option For More Caravelles

New York—Scandinavian Airlines System has picked up its option on an additional Sud Aviation Caravelle jet transports, bringing to 12 SAS's firm order for the two-engine plane. Options remain on 13 more Caravelles for SAS.

The airline expects to put its first six Caravelles into European and Middle East service next year, probably in a 70-passenger cabin configuration. The second one is scheduled for 1960 delivery. Total price tag for the first order is \$40 million.

N. Y.—San Francisco  
707 Flights Planned

New York-American Airlines will offer two daily roundtrips between New York and San Francisco with at least 700 ybs in December if the American Board grants authority rights for the route, the airline has advised CAA.

Frequencies would be increased to three daily nonstops within six months after initial service, American said. Both first class and coach accommodations are planned.

Although the airline did not say so, all flights probably will be to dual configurations at least during the early stages of jet operation.

American plans to inaugurate New York-Los Angeles jet service around the same time.

### KLM, Aeroflot Plan Reciprocal Service

KLM Royal Dutch Airlines and Karna's Aeroflot will begin weekly services between Amsterdam and Moscow next month under an agreement reached between the Netherlands and the Soviet Union.

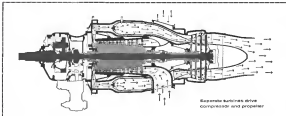
The Dutch carrier's DC-6Bs will serve Maastricht via Warsaw, while Aeroflot Tu-104s jet transports will fly direct between the two capitals. Services will be increased to twice weekly flights, each twice in the summer of 1979. Initial schedules not planned as of July 21.

BRISTOL: Power for the Wings of the World—No 5

# BRISTOL PROTEUS



## most powerful jet-prop in airline service



records proven the reverse-torque turboprop. The Bristol Proteus is the most powerful, most advanced jet-prop in commercial operation today—approved without restriction for use in passenger-carrying commercial aircraft. The Proteus is the first axial engine to reach the air lines of the world.

It is installed in the Bristol Britannia—currently setting new standards of vibration free comfort on record-breaking transatlantic and New York-New York schedules.

**Unique advantages.** The Proteus is unique in having the Bristol pioneered free-turbine system. This system gives high efficiency over a very wide range of operating conditions with a low specific fuel consumption—lowest of any gas turbine in service, military or civil. In addition, because it allows low propeller speeds, the free-turbine system results in an exceptional degree of quietness. Starting, warming and control systems are greatly simplified.

**Significant reliability.** The Bristol Proteus has a magnificent record of mechanical reliability. The 306 version started airline operation with an overhaul life of 500 hours. As a result of its performance in service, the overhaul life has already been officially extended to 1,500 hours—in just thirteen months of operation—the most rapid increase in airline history.

**BRISTOL**  
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THE BRISTOL AEROMOBILE CO. (USA) INC.  
400 PARK AVENUE, N.Y. 22, N.Y.



## Drag Devices May Aid Satellite Recovery

By Richard L. Swensky

Los Angeles—Use of variable area drag devices on satellite payloads is being proposed as a way to reduce aerodynamic heating and acceleration in satellite recovery.

Demonstrating use of drag devices is set next year, says Richard Huchins and Dr. J. Thakur of the Goddard Space Laboratories, both with rockets in three phases at a recent meeting here of the American Rocket Society.

These are:

- Passage from an orbit about 60 mi above the earth's surface
- Reentry through the earth's atmosphere and descent to an altitude at which final recovery can be initiated
- Final recovery, that is, deceleration of a vehicle to a speed suitable for land or water impact

Use of thrust to alter the angular orbit requires more projected fuel weight during its estimated 150 lb if a single impulse is used to depict a 200 mi orbit and drag is used to establish the final orbit of 60 mi, rather than use of retrothrust to depict from the original orbit and enter the 60 mi one. Thrust is used advantageously to reduce vehicle kinetic energy, applied tangentially.

### Change to Final Orbit

Changing from original to final orbit by steepen angles will, if decelerations are tolerable to the satellite stage, have advantages of reducing aerodynamic heating, reducing drag, and thereby increasing possible final distance error.

Use of drag aids for deceleration has several aspects and varying relationships with altitude and reentry angle. Variables that drag can produce a combined deceleration of 400 g must parachute. Example used was based on satellite trajectory at 190,000 ft, with a maximum elliptic drag area of 1,500 sq ft, slowing to 500 mph. It coincided with a circular elliptic drag area of 50 sq ft.

The required velocities, the paper states, could be achieved through a use of nonburning reentry and letting out of a parachute.

Stagnation point temperatures pose a more severe problem on most configurations and here, again, use of retro rockets to descend to final orbit altitude would be best in their reduction of exposure to heat flux, rather than use very large drag areas, which still demand major maneuvering to drag from

original orbit altitude and speed to final one.

However, the paper indicated, deceleration from 450,000 ft to 190,000 ft using a very large drag device would reduce heat inputs and surface temperatures.

### Drag Devices

Among conventional drag devices, parachutes appear to be the only feasible ones for large drag areas, the paper indicated, requiring the least weight for a given drag area. Although little is known of deployment of high Mach numbers and low densities, reduction problems should be lessened since non-tripodal force supports parachute weight and extension could be effected by a rubber or plastic tube attached to the skirt.

A metal par parachute could be extended by a series of springs attached between adjacent rings.

The paper added that three artificial means of extension may not be needed, since it has been reported that in Russian tests self-inflation have occurred as high as 40 mi.

Calculation of temperatures to be encountered by the parachute material shows there to be well above those of reentry, leaving three possible avenues of approach: use of heat and type material; use of ablative type material; or use of material which can withstand the surface equilibrium temperatures with the last being the most practical. Use of thin metal strips or woven metal cloth for the ribbon was projected.

The paper also stated that due to the very high velocities and resultant high temperatures and low densities at which parachutes operate, a material placed a stable function of the air will cost as an internal device. The air is there a conductor of elements. That makes it appear possible that the flow field may be influenced by magnetic fields (located in the parachute), resulting in increase of total drag while decreasing heat transfer.

Use of magnetic fields in combination with conductive metal drag area construction might give a very unique part in variation of drag area as the paper indicated.

Estimates on weight of a variable area drag device would be on the order of 175 lb. This is based on a system where, thus, high-temperature-resistant steel plates and passageways restraints in reentry, which would be a saving of given aerodynamic loads,

with an area reduction ratio of 5 to 1.

After the variable area drag device, has decelerated the vehicle and reduced its altitude sufficiently, deployment of a conventional parachute at speeds of less than Mach 1.5 would accomplish final recovery, after suitable support would have been reached. Use of a high drag vehicle configuration is deemed most desirable to a end meeting in a complex reentry parachute system for this final recovery.

A paper by Dr. Elmer Ruchlin of Jet Propulsion Laboratory, outlined a number of unsolved problems in connection with satellite tracking.

First unsolved problems, according to Ruchlin, was the appearance of a Russian satellite instead of a U.S. satellite.

Use of 70 and 40 sec instead of the U.S. 100 sec frequency was for proper guidance orbit and that of the atmosphere, with several strange effects in the atmosphere also being noted. Radio waves would get trapped near some upper layer resulting in stations could suddenly recover from the satellite path being able to hear the signals far considerably higher of base with nearly quadrupling from one half hour to an hour and a half.

### Processor Needed

Another effect was appearance of a processor in the level signal appearing about 30 sec before the start of the usual satellite signal. These processors could be tracked by intercomparisons or other tracking devices and coupled with speed information, enabled observers to track the satellite signal even recovering from a satellite overhead at one moment from the viewing station and the signal moving in between or being trapped by one of the actual reflecting layer.

One source of information, ground station, was the needed "ghost satellites," a condition in which signals appearing to be from the satellite still indicating position of the proper path when an intercomparisons was used to track the signal, occurred when the satellite actually was 180 deg around the earth. Possible explanation is that the radio waves were trapped in a rather peculiar way in the atmosphere, such that they reached the observer in precisely the right phase. The phenomenon was observed at 40 sec.

Another ionospheric effect made it appear as if the vehicle was appearing in multiple. Effect would have been noted except that upon rates would change



**Honeywell's RAM** a NEW  
**2-axis gyro designed to withstand missile shock and vibration.** Maintains tight accuracy under high acceleration and severe vibration. This hermetically sealed displacement gyro is smaller and lighter than its predecessors. It was especially designed and has been test-tested for missiles and advanced aircraft.

### Specifications

**Global Freedom 400** is built into 300° in roll

**Processor Rates:** Ranging from 0.1/min to 6°/min according to customer requirements

**Drift Rate:** Free drift rate is within 7°/min during release of 0 to 3000 cycles in 12 hr.

**Shock Resistance:** Designed to withstand 40 g shock

**Electrical Rating:** Torque motor operates on 115V, 50 cps, two phase

**Angular Momentum:** 1.5 x 10<sup>5</sup> to 5 x 10<sup>5</sup> g in oz-in. (for customer specifications)

**Rate Speed:** 25,000 cps

**Size:** 4 1/2 x 5 1/2 x 1 1/2 inches

**Weight:** 4.5 pounds

For further information write: Honeywell Honeywell Associates, Dept. JN-2738, 3450 Highway 106, Minneapolis 12, Minnesota

## Honeywell

**H Military Products Group**



Peter F. Wolf, Director of Communications,  
Western Airlines

Sq:

## "G-E 5-Star Tubes help make our Flight Simulator the nearest thing to piloting a plane!"

"Instrument flying and landing are stressed in the pre-flight training given Western pilots and co-pilots. Every instrument, indicator, and control found in one of Western's DC-8's is duplicated in our Flight Simulator—right down to General Electric 5-Star Tubes for maximum reliability.

"The picture shows me pointing to one of these G-E tubes as I stand beside the Simulator. Because equipment in this \$750,000 training device is fully reliable, our pilots, from the start, gain confidence in their instruments. Even when flying blind—note the cover over the window!—they learn to operate a plane with assurance and safety.

"All through our first of planes, General Electric 5-Star Tubes are installed in critical communication and navigation sockets. The failure rate of

5-Star Tubes has proved to be exceptionally low. They're long-lived—they help Western maintain fast flight schedules, and keep our electronic equipment in the air and out of the shop. No better receiving tubes are built, from our experience!"

Your nearby G-E tube distributor stocks 5-Star high-reliability tubes. Please him! Distribute Sales, Electronic Components Division, General Electric Company, Owensboro, Ky.



Progress Is Our Most Important Product  
**GENERAL ELECTRIC**

when a given part would change from pass to pass, welding is gained effect of putting dry tubes into rigid, it is possible material. Periods of between 15 sec and 15 milliseconds have observed and rate of period increase depended on whether or not Sputnik was approaching the magnetic pole in direction parallel to it.

Additional confusion was created by an unusual telemetry type aboard the Russian satellite, with frequency modulation appearing as a portion of the Sputnik II probe.

Signal received from Explorer I also turned out not as expected. Expected to produce a relatively constant signal with small modulations due to spin, the satellite signal instead developed spikes which increased in depth from negative to positive for several days until this reached a relatively stable condition some days later.

It developed that Explorer's motion was affected by antennas that spin around the longitudinal axis gradually turned into perpendicular, with resulting signal change. Explorer's original path had a spin like a rifle bullet around its axis, a gyroscope.

The Radio paper also indicated that a drift in test instrument in earth space and into space. Withholding the point were the data sheets received from Canada and Singapore where earth-based instrumentation was available.

Later it was ascertained that in fact, even the data was correct but that this was when the beam electron beam, some being measured and Gegen tube saturation was occurring. The original findings from Explorer I were verified by Explorer III.

Another strange occurrence, of Explorer I was the appearance of a dual transmitter, one predicted to operate for 11 days at 10 m. When performance was scheduled, the transmitter was again heard from for 25 to 27 days at the 10 m. level. The conclusion, according to Radio, is that after a life test has been completed, long testing for a long time or not come back to life, respectively.

A station for landing signals, extra exhibition on the surface of the moon by using inflatable large-diameter spheres with a payload in a protective posture in the center was proposed by Keith Elmore, General Astronautics.

Elmore's proposal called for use of the spheres in conjunction with a lunar satellite, to which data could be telegraphed back from the moon's surface. Several of the inflatable landing spheres could be carried in each lunar satellite, in the unoccupied state and could be inflated at the time of discharge toward the moon's surface.

Sphere design and construction would

## NOW... a major improvement in telemetry receiver sensitivity

Lower receiver improvement  
threshold by at least 6db.

### the Radiation, Inc., Model 8-100 RECEIVER PHASE-LOCK DEMODULATOR



This unit provides on-board system gain that may be handled into

- larger range
- less transmitter power
- smaller antennas
- better reliability

Designed for simple plug-in connection in standard 1400 series receivers (other receivers may be accommodated by modified version).

Write: P. O. Box 37, Melbourne, Florida  
for Bulletin RAD 8-110



Personal inquiries  
invited

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# RADIOPLANE DRONES

...the world's first drone family



United States Armed Forces for defense training

## WHAT IS A RADIOPLANE DRONE?

A Radioplane drone is an unmanned aircraft designed to be flown by remote or self-contained control to perform a specific military mission at the lowest cost and with the highest efficiency. Every drone produced by Radioplane is developed to meet particular defense requirements which cannot be fulfilled by man-carrying aircraft.

## WHY A DRONE FAMILY?

Drones are required to serve as targets for the evaluation of modern weapons; in the training of weapon crews, and for aerial reconnaissance. Each of these vital areas requires a special drone application. For that reason, Radioplane has developed this family of drones (left to right):

**RQ-44**—Evolving from the supersonic RQ-3, the Air Force RQ-44 is a highly sophisticated target drone designed to cope with the varying and comprehensive requirements of evaluating the full ability of modern weapon systems.

**OQ-15 TOW**—Standard radio-controlled aerial target for all the military services, the tough, reliable and versatile OQ-15 drone is used all over the world as an economical training target.

**SR-1**—Without endangering a pilot's life the U.S. Army Signal Corps' SR-1 can be flown by remote control as photo

reconnaissance missions, returning video images with a photo-optical report of enemy activities.

**RP-710**—Powered by Boeing's rugged RD-30 turbo-prop engine, the RP-710 provides high speed, and both high and low altitude performance at low cost for the training of gun and missile crews.

**RP-710B**—The RP-710B will carry the RP-36 target shell for launch at altitude over the Army's Nike range, thus eliminating the need for diverting a manned plane and crew into a workable job.

**RP-74**—(Shown attached to the RP-710B.) The rocket-powered RP-74 has very high altitude capability for training the Army's ground-to-air missile crews against fast, realistic targets.

**0041**—Designed for U.S. Navy fleet target air-to-air and surface-to-air weapon training, the XKD41-1 rocket

drone flies a preset course by programmed flight control.

Radioplane has been selected by the U.S. Army to provide complete contractor support for the training of White Sands Proving Grounds, New Mexico. This service includes far-ranging aerial targets, ground support equipment, and operational, training, and maintenance personnel.



For detailed information write: Customer Relations, Radioplane, 1000 Broadway Avenue, Van Nuys, California

## RADIOPLANE

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VAN NUYS, CALIFORNIA AND EL PASO, TEXAS



Object Being Viewed

Photoelectric "Retina"  
(Approx. 400 photocells)

Response Units  
(Approx. 10 units)

Control Console

Association System  
(Approx. 1000 memory cells)

**PILOT** model of a Perception to be built during the coming fiscal year at the Cornell Aeronautical Laboratory will resemble this sketch. Markers will register "yes" of photocells. Other sensor circuits could be used. E. G. color, radio, video, seismic, etc., signals would enter the association or sensor cells which would in turn make a response from the machine. On the pilot model

response will probably be made in lights or printing code letters. In fully-Perception could learn to speak and answer verbally. Actual number of sensor cells and response units has not been definitely set. Correlation of its human operation during "training" sessions. It is believed that full-scale Perception model eventually will make the use of several displays.

## Electronic Device Simulates Processes of

By J. S. Hux, Jr.

Whitcomb-Xerox stated there is in the brain of an electronic device that simulates the thinking processes of the human brain and may explain the mechanism of human memory has been developed by Dr. Frank Rosenblatt of the Cornell Aeronautical Laboratory under the auspices of the Office of Naval Research.

The new device has been given a personality through a robot motion model of a machine called a Perception which has actually demonstrated its ability to "think" itself.

Less than one month ago, the simplest type of a Perception model which could make only ten responses was placed in an environment that can send signals of squares. Without human aid it perceived that some of the squares were located on the right-hand side of the "field of vision" and sent signals on the left. After seeing about 50 squares, randomly located at various vertical positions on both sides of the

"field," the machine adjusted its ten responses so that one was always given when a square was situated on the left side of the "field" and the other when the square was on the right.

This was the first time that a completely representative abstract electro-mechanical system had organized an information into a concept. Later experiments have shown the machine to be capable of teaching itself the difference between several letters of the alphabet.

### IBM 704 Used

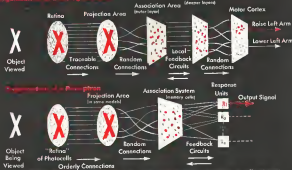
The work so far has been conducted on an IBM 704 computer expressly programmed to simulate the Perception's range of use. It has resulted in a data memory model of the Perception that takes about 30 min. to accomplish what an actual Perception could do in a few thousandths of a second.

This work has been under ONR sponsorship for about six years. Dr. Marshall Tappin, the ONR project of-

fered indicates that 500,000 will have been spent at the end of the fiscal year. The Navy hopes to provide about 500,000 during the coming fiscal year for the construction of a pilot model of the Perception with possible 1,000 memory units. It is believed that this machine will further prove that the Navy's money theory which indicates that a large Perception with about 100,000 memory units should be capable of making a very sophisticated field of vision through its own learning process in the teaching class of a human operator.

These fields include language translation, library research on a much more detailed and complex scale than was possible, various complex pattern services as contrast to the other devices never before made, gradient vectors for attack vehicles that could contribute to the decision-making capabilities now completely on the shoulders of the human crew. Communication services that would be able to accept concepts as well as coordinated data about an

organization as a biological brain.



**COMPARISON** between the generally accepted organization of the association brain and the Perception is shown above. Since of the sensory inputs to the illustration is limited to the eye. Generation between the active and the visual projection area of the brain are suggested and may be found. Beyond the point this becomes increasingly divergent. The association cells of the brain in this

model layout are likely to respond to widely varying stimuli from the same sensory input, indicating that they contribute to more separate associations of learning processes. Motor entries or response system is quite extensively over laid. Through in which profile structures that developed in a brain based on the laws of probability as applied by Cornell Laboratory's Knowledge.

## Human Brain

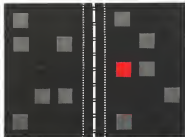
produced strategies and many others. Rosenblatt and Yarbush indicate that the major problem now is to develop small, responsive and reliable structures to serve as the sensory cells of the Perception.

Currently available equipment which could serve as response unit in the neighborhood of 500 per cent cost, compared with some of the proposed units which are considered to be purchased now, are comparatively large and costly.

### Size and Cost

It is hoped that the 100,000 memory cell Perception would not be larger than a normal size desktop and would not cost more than \$1 million per machine.

The memory cells in the pilot model of the Perception will probably be large electro-mechanical units which are complicated and relatively expensive, but can be counted on for reliable performance. It has been estimated that the construction of the pilot model will



**PILOT** experiment in which an actual machine simulated information was performed at Cornell Aeronautical Laboratory last June one month ago. A digital computer was programmed to function as a decision-making Perception with two responses. With no prior information the machine was exposed to an arrangement of squares as shown above. The squares were shown singly (dark squares). After seeing about 50 squares in various positions (light squares) the machine had adjusted its two responses to give one for the left-hand squares and the other for the right-hand squares.



## RELIABILITY or

### The Wonderful One-Hoss Shay

#### A Logical Story

Have you heard of the wonderful one-hoss shay,  
That was built in such a logical way  
It ran a hundred years to a day?

"For," said the Deacon, "It's mighty plain  
That the weakest place must stand the strain;  
And the way to build it is only jest  
To make that place as strong as the rest."

The Deacon followed the two cardinal principles for reliability.

1. Know the stresses your component will be subject to (in other words know the environment).
2. Build faithfully to the specifications that cope with this environment.

At CPPC we feel one of our great assets is careful manufacture by a skilled and conscientious crew.

Excerpts of the complete, original poem—  
The Deacon's Masterpiece or The Wonderful One-Hoss  
Shay by Oliver Wendell Holmes sent upon request.

Look to CPPC for SYNDROM



PROGRESS

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Clifton Heights

Pennsylvania

obtaining the first significant data from its application will probably require a year with the present effort.

A description of the Perception which will appear in an Office of Naval Research publication "Research Reviews" is the next item, made up approximately as follows:

The Perception is the first non-biological system known to be capable of classifying, conceptualizing and remembering an environment—especially a complex one and manipulated environment—in the absence of human training and control. The Perception can be expected to learn spontaneously without assistance of training from a human operator.

In comparison the most modern digital computers, automatic error-correcting called "beams," could be described as very rapid adding machines which stay on task when any original decision is required.

They are dependent on man to set up or program the method of solving if problems.

The Perception can sense its data through audio, visual and the other types of sensory proteins which supply information to the human brain. Radar and other electromagnetic devices could also be used as sensory. Artificial sensory units would provide the Perception with a much wider "range" of

experience than any natural system, but generally they could not match human sensitivity and resolution in certain areas.

The "central nervous system" of the Perception which takes the sensory information and classifies it, classifies it and uses it to form concepts, is believed to resemble and rival sensitivity to approximate the human pattern more closely than any other machine. The sensory cells of this system, millions of hairs of the Perception are for the most part wired together randomly and not connected in a precise pattern as in an ordinary electronic computer. Most of the cells are excited together when information is obtained by the Perception rather than along a specific sensory cell to form each bit of information.

His agrees with generally accepted physiological findings which indicate that the nerve fibers connecting living scanners and motor systems are organized and transduce except through the association or "thinking" cells which are apparently connected randomly. In a comparison the sequential of certain portions of the brain cells through part of this orderly network of direct connections can super the sensory and motor functions. On the other hand, the sensory system appears to be distributed throughout the association



### Radar Coordinates Missile Firing

Inventory data for Army's Missile Materiel System in General Electric Co's AN/TPS-59, used in cooperation with the AN/TPS-59 radar. Missile Materiel is designed to coordinate data of Nike and Hawk missiles in or defense of the U.S. East coast radar AN/TPS-59 has been installed at Fort Meade, Md., and Missile Materiel installation. New data combines two improved AN/TPS-59 radar with a newly designed receiver antenna to increase range coverage by 35% and to extend detection coverage according to the company. In general, design, installation of a Missile Materiel radar target is based on the need to be obtained from the best MAGE. Descriptive Catalog

# MATCH PSI FOR PSI



## Use P-H Heat-Treatable Electrodes

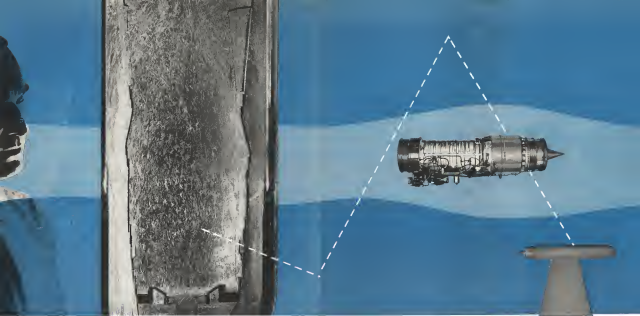
Now there's a P-H best heat-treatable electrode that matches exactly the carbon content of super-strong metals—expands the same way to permit heat-treatment. Result: You eliminate many of the machining problems of weld repairs on castings, forgings, etc.

Low hydrogen even-powder coatings and special core wires minimize imperfections—prevent hot and cold cracks. You get cheaper, smoother penetration with less spatter and slag. Electrodes handle easily—we ship for 30 and 40 inches, chrome-nickel, and 4130, 4140, and 4340 alloys. Get Bulletin H-48. Write to Dept. 223H, Harnischfeger Corp., Milwaukee 48, Wisconsin.

**HARNISCHFEGER**  
MILWAUKEE 48, WISCONSIN

we have electrodes  
and more





## Westinghouse proves jet combustion efficiency

This plastic combustor model enables Westinghouse engineers to predetermine combustion efficiencies in turbojet designs. Observations of the flow of the colored water and air bubble mixture permit visual evaluation of air flow patterns in normally unobservable areas of engines. This test method minimizes trial and error testing with handmade metal prototypes.

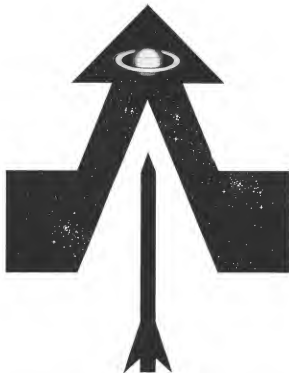
Development of the latest J34 configuration for use in North American Aviation's T37 trainer proved the value of this water flow analogy test

rig when design modifications to permit the use of avco and JP-4 or JP-5 were quickly and accurately evaluated. This is just one of the many complete facilities for research, design, development, testing and production of jet engines of the Aviation Gas Turbine Division, Westinghouse Electric Corporation, Box 283, Kansas City, Missouri.

4-1000

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2025, 11/28

This is the Missile Age. But where will it lead? What are its visions?

At Martin, advanced design engineering and pure science are independently at work seeking answers to these space-sized questions. *Advanced Design*. Top systems designers, requirements specialists and creative engineers—as such pioneering projects as VANGUARD, TITAN and a variety of related space systems developments—are already applying their cumulative knowledge to tomorrow's technical problems of lunar probe and manned orbit vehicle design.

*Pure Science*. And at our Research Institute of Advanced Study an already established and recognized organization of independent scientists is at work in the field of fundamental research, which alone can open the closed doors of tomorrow's technology. Work currently under way at RIAS includes new investigations into particle physics, gravitation, photochemistry and cosmic radiation.

Somewhere in the early hours of tomorrow, these two main bodies of creative effort will meet on the threshold of a new age beyond the missile.

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BALTIMORE-DENVER-ORLANDO

on establishing optimum starting points in theoretical studies.

In cases of that type it is possible for the human operator to force the machine to reach the required conclusions or to object to truth if, for no other reason, for example, a single Perceptron with four response units should be able to distinguish between four different geometric figures or letters of the alphabet or six glass shapes. If only two figures were used, the machine might focus on eyes about the location as well as the shape of the figures or on "field of vision," rather than about the shape alone. It is possible, for instance, to create and maintain the proper sensory traces in the machine so that it will learn the desired concepts. This is done through the feedback signals from the response units to the sensory cells, which are responsible for creating the sensory traces when the machine is learning by itself. Each time that a response unit is activated it sends a signal back through the sensory cells that is called for its activation.

This feedback signal is the mechanism used to measure the strength of the sensory cells and build the neuron traces. Psychologically, back signal "tells" the pattern of sensory cells that formed the response unit.

#### Creating Desired Concepts

A manual switch enables the human operator to create the desired concepts within the machine. Loosely termed a "sensory" button, this switch allows one trace to the sensory cells to be reinforced or "rewarded" when a given situation receives the proper response from the Perceptron. If an undefined character is given the operator says, "yes" or "no" that means cells which caused the response and lower their strength.

Rosenblatt's neuron theory and the Perceptron are based on the arithmetic matrix of probabilities, which do not require a complete description or wiring diagram of the neuronal organization of an animal. Such a basis allows the possible structure of a hypothetical neuron system to be deduced from a given set of inputs without knowing the exact internal wiring of the human or neuron cells.

This mathematical development which Corbitt describes as Rosenblatt terms the theory of statistical sequentiality, differs from most of those previously used in the study of mechanical computers and the human brain. These studies have generally depended on the use of symbolic logic and Boolean algebra and require precise knowledge of the wiring and switching arrangements in the complete system before responses can be determined. Digital computers are designed using these methods.

While Rosenblatt's theory gives the

HOW

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## in testing electronic systems

Many complex electronic systems—missile guidance—is a good example—may require testing that takes days by conventional methods. Yet the end function of such a system may test only a few minutes—**even seconds.**

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The SCATE system of automatic test equipment can solve both problems. It provides **self-checking automatic testing** which is **fast, flexible and fool proof.**

The system evaluates all important parameters of equipment under test, including:

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- 4 Voltage levels, DC and AC
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- 6 Mechanical response

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### "Match-box" Tubes

Need electronic coverage deep for receiving tubes, which provide greater stability, shock-resistance and improved performance, yet provide ease of tube electrical structure as conventional tubes has been developed by Westinghouse Electric's new "match-box" design. When N Y N "match-box" design structures combine construction, reducing consumption. It prevents more compact chassis layout, provides greater spacing between leads for lower inter-electrode capacitance.

Perceptics more testable, qualitative than the digital computer, the digital nucleus has the same advantages over the digital computer that it does over the analog computer. It is specifically designed to perform calculations using mathematical processes very rapidly and accurately so that it can solve complicated equations in minutes when most would require hours.

Training the Perceptics has mathematics would be as tedious as teaching the human and it would push this but about the same results. In total, it would be a waste.

### Perceptics' Promise

Great strides are being made with digital computers but as far as human change for a given use, speed of operation and the ability actually to duplicate the human process of debugging data without without devices on digital program has approached the Perceptics in accuracy.

Roundall believes that the next viable computer of the future will combine features of both the Perceptics and the digital machines. He also believes that they will be designed only after investigation in the field have devoted more time to inter-operations made in contrast to the incidents. Roundall's future speculation that exists in many quarters today. Roundall's Ph.D. is in psychology but he has devoted time years to his technical mathematics and electronics which has reinforced his belief that ideas of great significance will result from more cross-fertilization between the fields. As Roundall is 29 years old he should have considerable time to see if his past will be proven.

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Pioneer-Central's cryogenic and instrument design and production experience is now being utilized in the production of cryogenic valves, pressure sensing probes and liquid level sensors for advanced missile systems.

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## Expansions, Changes In Avionics Industry

Lattice Industries has purchased Avtron, Inc., Linden, N. J., and will acquire the company's market in 1.5 to 2 years, growing list of acquisitions. Avtron, whose current annual sales are approximately \$10 million, employs 500 persons. David Light will become vice president of Avtron and will continue, vice president of Lattice.

Other major personnel expansion and changes in the avionics field are:

- **EBAN Controls, Inc.**, will be, as a unit of Mack Trucks Inc. electronics division, following Mack's decision to get out of the electronics business. Mack will complete present commitments but is not accepting new business.

- **Stanford Research Institute** has formed new Radar Acoustics group to carry out studies involving engineering and operation of proposed Air

Force Air Weather Service, nation-wide storm detection network. Long-range plans include research on application of computers to weather analysis and forecasting. Dr. Myron G. H. Lough leads this group.

- **Kaiser Aircraft & Electronics**, division of Kaiser Industries Corp., has formed new engineering research and development department which will be located at company's Richmond Machining plant in California. Walter G. Croy will head new group in addition to being responsible for Richmond plant operations.

- **Sun Electric Corp.**, Chicago, has acquired a substantial facilities and produced line of Texas Instruments' plant instrument department, which will be integrated into Sun's own instrument division. Texas Instruments is withdrawing from plant instrument field.

- **Electronics Corp. of America**, Cambridge, Mass., has established 25,000 sq. ft. manufacturing facility in Puerto Rico, near San Juan, which will produce electronic controls.

- **Clifford Electronics Inc.** has broken ground for new 26,000 sq. ft. plant at Clark Park, Ill., which is expected to employ 150 persons.

- **Logan Aircraft Co., Inc.**, Torrance, Calif., has acquired electronic assets of Seaver & Smith Co., New Kensington, which produces missile support equipment will be headed by John Downing.

- **Stanford Electroacoustics, Inc.**, Frederick, Md., producers of alarm and other electroacoustic devices, has received new 20,000 sq. ft. plant at Walkersville, Md.

- **Mass Laboratories, Boston**, has become division of Cole Electronics, Inc., has Doug Ford, Mass. plant head of new acquisition and becomes vice president of Cole. Mass produces electronic devices and microcomputers.

- **Nucleo Ultrasonics Corp.**, Morristown, N. Y., has acquired Alcon Instruments Inc., Little Ferry, N. J., also producers of ultrasonics. New acquisition will continue to produce location, with Service Carling continuing as president of new Nucleo subsidiary.

- **Grinnell-Harris Electronics, Inc.**, Richmond, Calif., is one of new firms which will design and manufacture airborne filters, magnetic amplifiers, delay lines and related devices. Morgan Harris is president, Arthur Grinnell is vice president. Company address: 4130 Tangle City Blvd.



## KEY ENGINEERING OPENINGS AT VUGHT

### ELECTRONICS

Project leaders advanced guidance and control and fire control systems for missiles and high-performance manned aircraft. They made it—like Vought engineers designed Regulus II to serve safely, efficiently aboard the Navy's newest nuclear-armed submarines.

They shockproofed the missile against underwater blasts. They conditioned it for polar air, or equatorial heat. They made it—like Vought's earlier Fleet veterans, Regulus I—a dependable weapon, accurate from conventional or nuclear warheads, from surface ships or highly maneuverable, mobile shore launchers.

Aboard its special, globe-grubbing Regulus II, they moved securely any distance to its launching point. They

**Stability and Control Engineer, E.E. M.E.**, or A.E., with emphasis on flight stability and control problems or dynamics. (Space and considerable prior production study or extensive experience in research or design of control and control systems for high-performance missile and aircraft).

**Avionics Design Engineer, E.E.**, or Physics Degree with demonstrated capability for antenna design. To join active projects involving design of flash mounted, control and electrical circuits at all frequencies for very high-performance search and intercept.

**Fire Control and Monitoring Systems Engineer, Regulus E.E.**, or Physics Degree, or least 2 years experience in radar data link, or fire control systems, and strong ability at this work.

**Test Equipment Engineer, Regulus E.E.**, or Physics Degree and at least 2 years experience in design or repair of field (theater) based background in electronics design with emphasis on digital computers or microwave systems. To join in the design of complete electronic systems for search and intercept subsystems.

**Reliability Analyst, Regulus M.E. Physics E.E.**, or Math Degree, broad knowledge of electrical and mechanical systems, experience in operations research or reliability. Helpful statistical methods experience.

To arrange for a personal interview, or for a prompt report on these or other career openings, please complete for:

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## Vought Vocabulary

## in'ge-nu'i-ty: designing a 12-ton missile to fit inside an atomic sub

Chance Vought's Regulus II missile is twice as long as a city bus. It is crisscrossed with delicate instruments, armed with a nuclear warhead. Yet Vought engineers designed Regulus II to serve safely, efficiently aboard the Navy's newest nuclear-armed submarines.

They shockproofed the missile against underwater blasts. They conditioned it for polar air, or equatorial heat. They made it—like Vought's earlier Fleet veterans, Regulus I—a dependable weapon, accurate from conventional or nuclear warheads, from surface ships or highly maneuverable, mobile shore launchers.

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## Toroidal Coil System

Maximum torque, toroidal coils, which previously had to be wound by hand, can now be produced using new and winding machine developed by Inco. Inco's toroidal coil system is shown in a four (below) to demonstrate its design.





Back from beyond, the pilots of NAA's X-33 rocket plane will report on the new problems they discover in Outer Space.



Outward bound, USAF's Thor will take space to the mighty thrust of a rocket engine built by the Rocketdyne Division.

the GAM-87, advanced air-to-ground missile for the Air Force B-52.

Both missiles and aircraft depend on automatic control systems—the electronic eyes and ears of the Space Age. Automatic Division is producing these vital systems in quantity—with complete reliability.

#### The new weapons-system concept

America now shapes its defense around complete weapons systems, each designed for a specific role. Some will be guided to target by electronics, others will have a human pilot's ability to choose place or report results. NAA builds both—and both are needed for complete security.

Los Angeles Division is building two advanced guided weapon systems for tomorrow's Air Force: the B-7A, which will have global range easily more than 2,000 mph, and the F-33S, which will intercept would-be

invaders far from our shores—and give us the reach to crush little wars before they become big.

#### Toward a brighter tomorrow

Many of North America's people are working on projects that promise a more abundant life for a world at peace. The Atomic International Division, for example, is developing practical methods for turning atomic energy into low-cost electricity. Two major power reactors are already in operation, a third is on the way far across Southwest utility companies.

Today, in North America and its dominions, you'll find a potent combination of rockets, engines, and production men in *Aeroform Industry*. Because they are constantly forging ahead into vital new technologies, much of their work holds immense promise for science and industry.

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...will be another V-day for the free world—perhaps, then, day has yet known in the inner offices of the Pentagon... in secret areas of our defense industry... the effort is being spared to speed the day.

For it will be a human pilot—in command of a craft that will bring both him and his secrets safely home—that will truly conquer Outer Space.

The first American craft in attempt this concept is now in its final construction stage. It's the X-33—missile shaped and rocket powered—product of a research project sponsored by the National Advisory Committee for Aeronautics, the Air Force, and the Navy. It will discover what man encounters when he enters space—and when he returns to the earth's atmosphere.

#### America is closing the gap

The Army's Explorers give us dramatic

proof that America had not been lagging in the race to space. The rocket engines that put the Explorers into Outer Space were minor modifications of the same engine NAA's Rocketdyne Division has been delivering to the Army since 1952. Four of America's major missiles use engines built by Rocketdyne: the Air Force Atlas and Thor, the Army Jupiter and Redstone.

Missiles of all types use principles discovered by Missile Development Division in its 12-year research program. This division is now at work on

## THE DAY AN AMERICAN RETURNS FROM OUTER SPACE...

# NEW



## NEW TYPE 6 SERVO MOTORS

Here's one of the smallest precision servo motor series currently available. The new Daystrom Transcoil Type 6 Motors are wound for 25-, 33-, and 52-volt operation. Control phase is center tapped for operation with transistor drive. These Motors develop .125 cc-wt. stall torque and 6000 RPM free speed. Each unit weighs only .9 oz. and is less than 1 1/4" overall.



## NEW TYPE 8 INDUCTIVE POTENTIOMETER

This Inductive Potentiometer is an infinite resolution  $\omega$ - $\phi$  potentiometer whose output voltage is linear rather than sinusoidal with the angle. Output voltage phase is dependent upon the direction of shaft displacement from null. When operated into load resistance not less than those specified, output is linear within .25% through an angular rotation of  $\pm 85^\circ$  through null to  $-85^\circ$ .



## NEW TYPE 8 SYNCHROS

The new Daystrom Transcoil Type 8 Synchro Line consists of transmitters, control transformers, differential and repeaters. Dimensions equal to BuOrd Spec 8. Operates: 115V 400 cycles or 20V 400 cycles. Accuracy of  $\pm .10$  minutes at standard. Other accuracies are available upon request. Corrosion resistant construction throughout. Conforms to MIL-E-5272-A. Operating temperature range is  $-54^\circ\text{C}$  to  $+125^\circ\text{C}$ . Higher temperature units also available.



## NEW TYPE 11 INERTIAL DAMPED MOTOR

Here's inertial damping with no reduction in no-load speed! This new Type 11 Motor (BuOrd spec 11) provides acceleration or deceleration damping at high-speed and high-gun servo operation. In non-critical applications, this motor can be used as a low-cost substitute for damping motor generators.

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## 1957 FILTER CENTER 32232

• **Solid-State Switching Device**—New type of solid-state switching device consisting of thin layer of aluminum oxide film deposited on two pieces of germanium has been developed by Army's Directed Electronics Force Laboratory (EXDPL), Washington, D. C. Device exhibits properties of capacitor with breakdown voltage of approx. 16 v., capacitance as low as 9.945 picofarads, and a leakage resistance made in the 10-megohm range. Upon application of initial voltage, resistance drops to one ohm or less. Compared to diodes, new device is smaller, less expensive, more resistant to shock and vibration and high-energy radiation, and requires no power supply.

• **New High Temperature Resistor**—New high temperature resistor line, consisting of combination of chrominel and silicon, suitable for operation at  $150^\circ\text{C}$ , has been developed. Battelle Memorial Institute, Medical Analogies has also received patent charge to manufacture over 1,000 ohm resistors at  $150^\circ\text{C}$ , has temperature coefficient of several hundred ppm per million per degree throughout over range of  $-60^\circ\text{C}$  to  $150^\circ\text{C}$ , and resistance of several hundred to several thousand ohms per square can be obtained.

• **More Sensitive Photo Cathode**—General Electric Co. has cut price of pre-production samples of its new silicon controlled rectifiers by 30%.

• **Mobile Infrared Tests**—Air Force's Navy project to insure uniform solution characteristics of a variety of U. S. missiles has been completed, supplementing earlier tests on aircraft carrier conducted at Phil's Park in California. Tests were run at Air Force Missile Test Center, Florida, using both land and ship-based radiation analyzers. Air Research & Development Command sponsored program.

• **Two-Step Debris-Block**—This year a British Vickers jet bomber made a night flight from Ottawa, Canada, over the U. S. as far south as Cape Hatteras and back to Canada, using the back coverage of the pair of Debris screens. Newfoundland Debris screens are installed throughout the flight and oceanic high, although without a corresponding station in the U. S. track information only without stage data could be obtained. Newfoundland Debris screens are installed for evaluation of Debris coverage over north Atlantic Canada and Portugal.

• **Squad On Dotted Line**—Major contract awards recently announced by various manufacturers include:

• **Ford Instrument Co.**, division of Sperry Rand Corp., has awarded \$14 million Navy contract for production of Mark 115 guidance computers for Tartar and Mark 119 computers for Terrier missile systems.

• **Sperry Gyroscope Co.** has received \$17.5 million Navy Bureau of Ordnance contract for production of Tartar missile guidance radars and associated equipment.

• **Lithotek For Electronics, Inc.**, Boston, has received \$2.8 million Air Mail Contract contract for its AN/APN 105 Doppler radar airborne navigation system.

• **Consolidated Aircraft Corp.**, Westbury, N. Y., will design and produce mobile check-out equipment for Navy's Polaris intermediate range ballistic missile under sea control from Lockheed Missile Systems Division. New equipment will check continuity, leakage, resistance of 1,000 electrical devices.

• **Omegan Radar & Television Division** of The Singer Corp. awarded \$780,000 contract to develop airborne and ground receiving and data handling equipment for Air Force's AN/ALD-5 "Tall Tom" reconnaissance system. Omegan is a corporate associate of Mottman Electronics.

## EXPERIMENTAL TEST PILOT

positions open at Bell Aircraft Corporation, Buffalo, New York. Extensive jet and fighter aircraft experience required. Formal educational background and experimental or production flight test experience desired.

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AVIATION WEEK, July 7, 1956



T33-POWERED Model 107A is tested and by Vertol to check out design features of new helicopter, also is a demonstrator.

## Vertol Unveils Twin-Turbine Model 107

By Ernest J. Bulbas

Madison, Pa.—Prototype of a new twin-turbine transport helicopter designed to put commercial rotor-wing scheduled passenger operations on a paring basis, will be publicly demonstrated for the first time this week by Vertol Aircraft Corp., at Philadelphia International Airport.

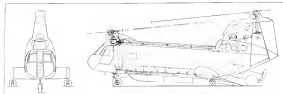
Airline configuration of the new 160-mph Vertol 107 (AW Feb. 17, p. 21) which the company expects to have

ready for delivery in 1965 will normally seat from 23 to 25 passengers. With high-density seating up to 34 passengers will be carried. Its airframe encompasses 10 of which have been recently adopted by the U.S. Army Transportation Corps will have provision for 22 troop seats plus troop commander or 15 troops plus two medical attendants or various cargo payloads ranging from one and a half to two and a half tons.

Army's Vertol VHC-1 is should start coming off the production lines here.

each next year. Contract calls for delivery of seven aircraft powered by two General Electric T55s and three with Lycoming T53s. The latter contract awarded by Navy, under and funded by the Transportation Corps, totals more than \$10 million.

Indications are that recent Army is favoring the General Electric-powered version is that the 1,000-hp plus turbine will provide the VHC-1 with higher performance capability, particularly in the single engine condition.



SCHEMATICS show components of production configuration (T55-out version, below) and earlier 107A tested (above) powered by two engines (see dash) will be located between twin turbines with larger, vertical rotor shaft positioned in collapsed position.

three the Lycoming T53 can provide at its current 825-hp rating.

And helicopter operation will require no change in rotor hub or rotor shaft of helicopter and Vertol is confident that when its 107 is ready for the airline market in 1964, the T55 also will be available in the 1,000-hp plus class providing prospective customers with a choice of either engine.

In its airline configuration, the 107 will tie strength with the first Lycoming twin-turbine Sikorski S-63 for position in the next generation of transport helicopters, and only among current operators but also those who have been holding off entering the field until one of the advantages of capacity to be successfully feasible become available.

Looking at Vertol is that the new class of helicopter can be expected to have an impact on the helicopter air line industry, similar to that provided by the DC-3 in existing transport operations.

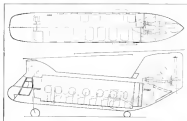
### Strong Competition

As an indication of the heat of the competition in which the Model 107 and S-63 are engaged, Vertol's management a little over a year ago authorized provision on the project solely with company funds. In date it has spent some \$1.5 million on a development program which has entered design into net profits.

One is an attempt to gain a jump as the competition by having a more of dismountable fuselage. Being as soon as possible, the 107A tested configuration was produced and started in flight program in April proving out the maximum design features of the project.

Sikorski's S-63 is not expected to roll out until next year.

Model 107A is slightly smaller than the production configuration, actually represents an early stage of the 107 development, but is close enough to provide useful engineering test data and



REAR LOADING RAMP has hinged door retracted up to engine disk to provide 70 in. over-head clearance. Ramp can be lowered to ground carrying loads longer than 20 ft, when



BACKUP COCKPIT (left) of Army VHC-1 shows dual control layout with instrument flight panel. Full-length transport bench on either side of cockpit may be pivoted for rapid exit. Cabin window (looking forward) has retractable roll-type door on right side.





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CONTROLS and transmission shafts are located in fuselage structure for optimum accessibility. The clamshell door provides easy access to main rotor and its various engine components, without entering the fuselage.

provides a flight vehicle for checking out production model features.

Basic layout of the 107 assembly Vertically HUPD serves the main rotor hub (providing location of the side-by-side turbines clear of the rotor area).

In discussing specific aspects of the new helicopter's features with American Helicopters, Vertically HUPD President-Engineering Inc. R. Douglas noted that the basic position is a prime and essential factor in the 107 having a considerable larger usable cabin area (over 500 sq ft) than the preceding H-21—about 600 sq ft—although the fuselage is eight feet shorter in overall length than the H-21 and only eight feet longer than the HUPD.

Other main points of the 107's design pointed out by Douglas:

- Full cross-section rear loading ramp to provide rapid loading of vehicles, including the Army's three-quarter ton truck.

Hydraulically operated ramp, which can be controlled from the cockpit or by a cabin attendant, is designed to provide a clear height of 70 in. from the cabin down to the ground. Ramp can also be positioned at an desirable angle to permit storage of cargo that will project from the aft end of the cabin, or that can be removed.

- Safety feature provides placement of all fuel in puncture-resistant bladder-type cells in external ducts designed to



CLAMHELL doors provide access to main components in 107's nose.

agitate from the fuselage, in event of a crash to minimize fire hazards. All shaft and fuel fittings are designed to seat closely and not require the tools.

- To simplify maintenance, all system stress is positioned clear of the cabin to allow most of personnel to enter the fuselage. Electrical, hydraulic, control lines and transmission are routed over the top of the fuselage external of the cabin structure and housed in a tunnel which is completely accessible by means of hinged panels. Walk-in air provided along the fuselage on either side of the tunnel.

- Modular concept is utilized for all major components requiring maintenance; package replacement is planned for both transmission, rotor box, controls and shaft, so that the same in the field can pull complete assemblies for overhaul or repair at maintenance depots rather than attempt to do the job on the spot. Vertically's goal is package or placement of any major components in 30 min in the field. Projected maintenance man-hours for the 107 is under 60% of that now experienced with the H-21.

#### Few Rely Components

Only three allowed in the belly are a few essential mounted subunits. Doing no more. All controls are taken up on the pilot's side of the fuselage and are cascaded in a compartment for such areas, including boost attraction for the 107's hydraulic system. Portions of the controls that go under the pilot's seat will lift with removable floor sections.

All tubing in external and all ground level and all of levels can be read using sight gages. Douglas also pointed out that the 107 will have no ground fittings anywhere in the nose section of the



ROCKET PROPELLED TEST VEHICLES

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### Vertal Model 107 YHC-1 Military Prototype

#### SPECIFICATIONS:

Gross weight	15,550 lb.
Useful load	6,400 lb.
Weight empty (with military equipment)	9,150 lb.
Overall length (Main fuselage)	44 ft 9.6 in.
Height	17 ft 7.3 in.
Rotor diameter	45 ft 4 in.
Color	
Length	22 ft 2.4 in.
Height	5 ft 10 in.
Width	6 ft 7 in.
Volume	795 cu. ft.

#### Seating capacity:

- Crew: Pilot and copilot (can be flown by pilot only).
- Passenger: 22 troops or 15 horses.
- Engine: V-33-GE-6 (with gear reduction) rated 1,024 hp (imp.) 875 (net).

- \* max.—Maximum rated power
- † max.—Normal rated power

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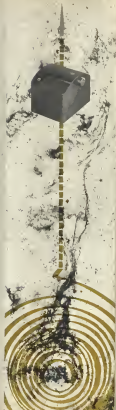
# Whittaker cracks the barrier in gyro cost, simplicity, and instant readiness

## the Revolutionary Whittaker Spring Driven Gyro

Quantity production of smaller and larger drives with flight times of 45 seconds to 10 minutes brought a demand for a low cost mechanically driven gyro that could reliably and accurately serve the functions of roll, pitch, and yaw control. The goal at Whittaker's development program was to match or exceed the performance of electronically driven gyros, at 1/4 to 1/5 the cost. Problems arose in select, including (a) and hood of casing, which Whittaker solved with a mechanically wound helical spring (b) rotor design, where Whittaker is using a relatively heavy rotor turning at low speeds (c) method of transmitting power internally to the rotor (d) structures and packaging.

The first operational unit, which was dropped for a flight time of 2 minutes, was so successful that it brought an immediate demand for low applications, and more rapid development. Spring driven gyros are now being built at Whittaker for 30 seconds flight times, with drift rates of 0.025° per minute, angular freedom to 360° on the outer gimbal and 11.5° on the inner gimbal, and environmental capabilities which include shock to 100 G's, vibrations of 20 cps to 2000 cps at 10 G's, and knee accelerations of 30 G's.

The gyro is formed and cased at the factory, and is immediately sealed for instant readiness in the field. Storing time ranges from 0.1 to 0.5 seconds.



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a leader of more than 350,000 gyros, custom designed and built for meeting military applications offers specific facilities for:

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Field Service

These facilities, together with the gyro industry's most competent and experienced engineering and technical personnel, are at your disposal to solve your most existing gyro problems.

To get these facilities to work for you today, or for complete information on the spring driven gyro, write, wire, or phone Donald J. Runnison, Director of Field Engineering, Whittaker Gyro, a Division of Telecomputing Corporation, 14277 Euclid, New Mexico City, New Mexico. Phone: ST-NE 5-2121.

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cution will be used throughout, with each being permitted to "sweep" and collect oil in traps. This outcome has been found very effective on the rotor which bearing housing of the H-21, he reported.

Whereas the H-21 rotor maintenance has an own integral oiling system, a single blow-in on the rotor will null and void all for the 107's maintenance system.

Forward rotor head, with its wing, pleating and cooling unit, will come off from top of the helicopter, the rear rotor head system will be removable through the cargo door, which extends across the top of fuselage.

All-metal interchangeable rotor blades will incorporate electrolytic seals during system shutoff. If air rubber boots which has been tested successfully at Air Force's Eagle AFB closure hangar and at Mt. Washington, Mass.

With a major portion of the fuselage structure of forward fuselage section, Vertel experts expect maintenance on production to be reduced that the 107 structure will take some 15% fewer man-hours to build than the H-21. Fuselage will be conventional structure of aluminum alloy with titanium and in engine hot area.

In addition to rear loading ramp, the 107 also has a door forward, on the right side just behind the cockpit; of the overhead loading type to provide better workability among than the side door type.

Fuselage is designed for amphibious capability. Vertel expects to have the

107 authorized to operate in Sea State 3 normally (the V-44 has similar capability), by adding inflatable bags to the type of puncturing struts, to provide additional lateral stability, the new helicopter is expected to be capable of operating in Sea State 4.

Cockpit will be provided with full dual altimeter instrumentation, if desired including anti-ice/altitude equipment either the Vertel-developed vacuum stabilization augmentation system or an electronic anti-ice/altitude equipment.

One of the features included in the cabin version is a seat for the troop commander located behind and between the pilot so that the commander can maintain close contact with the flight crew during assault operations and his crew. Crew and troop commander also have communication with the troops via a loud-speaker system. This close liaison between flight crew and troop commander has been proven a necessary feature in French combat operations with the H-21 in Algeria.

Fuselage also incorporates a panel in the floor for greater ease of looking over externally carried cargo. This method permits a man in the cabin using a hand hook, in cargo cables tied to cargo, draw these up and connect them to the cargo strap, obtaining need for a man on the ground.

Vertel focuses considerable stretch possible with the present 107 configuration and operators are that future larger models will maintain current, one-stop looking configuration.

## Killian Stresses Creative Research

Dallas—More critical appraisal of the quality of U S research effort a necessary to make sure that research is as creative and productive as possible, according to Dr. James R. Killian, Chairman of the President's Advisory Committee on Science.

Calling for greater emphasis on quality in the national research effort, Killian said "we can no longer accept all research on faith, as believe that so-called, just because it is called research, is bound to be good." He spoke before a group of scientists at the dedication of a new Texas Instruments semiconductor plant here.

Killian said that the quality of research depends on proper allocation of effort and money between research and development categories. He said that too much emphasis is given to development and too little to basic research. In the area between basic research and development, Killian said there are difficulties in supporting research work which, if these were there, could save costly mistakes in hardware development.

At a symposium on solid state devices held at the Texas Instruments plant, industry experts produced a general exposition of the use of various devices based on the current state of the art. J. A. Morton, director of development for Bell Telephone Laboratories, held the group first with the addition of defense science technology, the basis for a significant development effort could arise now.

Morton said that the current body of knowledge is complete enough to do most research that is there to live on development effort should improve reliability and cost factors which are "prevalent to the creation of large complex systems for military and industrial use."

Despite the present emphasis for expensive, Morton pointed out that continuing research can be expected to produce new knowledge and new solutions in the field.

Transistor electronics is the leader of a broader field of solid state electronics to come, Morton said. "Some of the newest knowledge of the physics of lay

semiconductor, ferroelectric, dielectric, piezoelectric and organic materials is already being developed into new technology significant devices. Then we have ample reason to believe that there is being generated now, and will be in the future, research knowledge that will create an even greater solid state technology than one can see by simple extrapolation of the present."

Corbin K. Test, Texas Instruments assistant vice president and director of research, told the group that Texas Instruments is now reaching out to other fields and there is enough reason to believe that there is enough experience in these two "we are no longer flooded in requests for new specific types."

Killian said new being concentrated on such specifications, improving certain parameters, increasing reliability, and testing cost. Test observed that research is being studied intensively and that it is believed that some of the research tools and techniques now employed will bring deeper understanding, improved processes and techniques and better performance.

Test noted that while the major part of innovation and creative effort is carried on in government and military, other scientific components offer possibilities of expanded operations. He listed as some phosphor and gelatin research in materials that theoretically might operate substantially up to 100-400°C and that gelatin research, because of its high surface mobility, might be expected to be superior to others for high frequency transistor operation.

Noting that for broad application, research must have a functional capability over a wide frequency range, Morton J. Kelly, president of Bell Telephone Laboratories, said that present semiconductor technology permits designs of transistor structures which can operate over a frequency range of 1,000 mc.

Recent research has demonstrated an extension of this range to 8,000 mc, Kelly said, and it now appears possible that semiconductor structures will be realized that can operate at frequencies as high as higher than those of all present design electronic technology.

Power capabilities of 50 watts have been realized at the lower frequencies, and Kelly estimates that the power requirements of about 80% of existing mobile applications can be handled by transistors with the current state of the art. Combining frequency and power limitations, Kelly estimates that at least 75% of present electronic tube applications are technically vulnerable to semiconductor substitution.

Kelly told the group that more than functional adequacy is needed to accomplish this penetration of 75% of electronic tube applications. He said the



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is used to provide precise, rapid measurements of angular position. It reads longitudes in arc minutes measured by shaft rotation. Such input is changed to 10 decimal long life in continuous driving speeds up to 1000 R.P.M.

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To probe the propulsion future... and to build and test greatly advanced propulsion systems for coping generations of flight vehicles, Pratt & Whitney Aircraft is now opening its new Florida Research and Development Center. This facility supplements Pratt & Whitney's main research and development installations in Connecticut.

The new Florida Center, freestanding and back by Pratt & Whitney Aircraft, is unique in America's air industry. Here a completely air-conditioned plant with 17 acres under roof is specially designed and

equipped for the development of new power plants of virtually any type. Testing is handled in special isolated areas; the nearest is four miles from the plant and many miles from any inhabited area. The new Center can be greatly expanded on its 10-square-mile site. Continuous isolation is insured by a vast wildlife sanctuary in which the Center is located.

Today about 1800 people are employed at the Center, of whom about half are scientists, engineers and highly trained technicians. By late next year, a total of about 3500 employees is anticipated.

The new Florida Research and Development Center is one more reason why Pratt & Whitney Aircraft is able to continue producing the world's best aircraft propulsion systems... in whatever form they take.



**ISOLATION**—Ten square miles comprise the site of Pratt & Whitney Aircraft's new Florida Research and Development Center. Experimental shops and offices covering some 17 acres are in the foreground, while the test areas, barely visible in upper left, lie four miles in the background.

**LOCATION**—The new Center is located at United, Florida, midway between West Palm Beach and Lake Okechobee, in the upper Everglades area. It is almost surrounded by a wildlife sanctuary. Most employees live in the cities and towns along the east coast of Florida, driving to the Center on excellent new highways.



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parent unit, of stability, length of life, and cost of production are made quick for successful competition in new areas.

Effective understanding and control of safety effects can arise by relying on a law to minimizing these shortcomings. Right now, reliability and long life can be obtained by controlling the service, but the pressures required are so much that, first the area of application. Understanding of service of both is expected to come with continuing research and working law, and pressure will permit massive application.

Discussing costs, Mark Shepherd, Jr., vice president of the Servocontrol for Components Division, and that mechanical production techniques along with new device developments, will not manufacture costs over the next decade and that these costs will be passed on to the customer. He predicted that the full impact of mechanization will be felt by 1965, and that this factor plus such developments in the glass transition which a few firms have already built, will not permit mechanical parts to a point where they are directly competitive with semiconductor as a cost basis.

Shepherd said that direct transistor power will also fall as production economies are realized. He pointed out that average prices of these devices had dropped 60% in the last four years and predicted that the downward trend will continue.

### Manufacturer Denies P.16 Design Charges

General-Purpose Instruments of Alhambra, P.A., designers of the combat-oriented Swift P.16 ground-attack airplane, have denied charges made by William Weaver, Paul Chandler (AW Jan. 16, p. 297).

FWA told Aviation Week that the conflicts between them and the responsible government agency (KLA, Kampftruppe Abteilung) was based on British requirements accepted by the Swiss as design orders.

Company said it had ordered KLA of changes to design, also as suggested by contract.

Company is still trying to get a cancelled order for 500 P.16s reactivated. It was cancelled by decision of a Swiss court, which ruled last June that the Swiss federal council had been three months after the order was placed by a majority vote of parliament. Reason cited for the cancellation was that a design delay was expected due to redesign of the plane's hydraulic system which was blamed for the accident in the third prototype.

Major construction centers around the aircraft's hydraulic servo-control system

have replace hydraulic system follows British requirements and now British and U.S. components.

Concept of the servo-control system is the Leduc-Jacquet type of French design.

Pumps, accumulators and high-pressure lines of the servo-control system are duplicated, but surface sensation and status lines are not. Design of the system has met British requirements, company said.

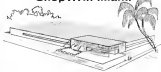
There is some possibility of interaction between valves in event of failure in one valve, because these share common return lines. In the case of a return line failure the control system

must operate enough fluid for a system to have. In the Leduc-Jacquet system the only fluid gauged is the amount needed to activate a control surface. There is no constant leakage flow as in most other types of control.

P.16 accident has been traced to an interaction between the servo system, hydraulic system and the action side of a pump of the servo-control system. Primary cause of failure was not in the servo-control system nor dependent on it.

PFA technicians plus other Swiss and foreign experts have been able after rigorous tests to duplicate the cause and sequence of the accident.

## AIRWORK Opens A NEW Accessory Overhaul Shop... In Miami



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- Airplane overhaul for the new jobs will start by early summer.
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ITALIAN Nibbio business has a gross weight of 2,150 lb., cruise speed of 185 mph. Landing 0-368 is rated at 180 hp.

## Nibbio Aims at 'Second Plane' Market

By David A. Anderson

Miles-Airventure's P-14 Nibbio two-seat executive transport is being offered as a "second airplane" to companies already operating large and more expensive twin-engine business aircraft.

This sales concept is an addition to the company's overall effort to sell the airplane for what it is—a light transport designed for European business use as their "second plane" idea, similar to the separate idea used by some branches of small European cars, seems to prosper despite the tough competition they face on the executive market.

Does American planes. Airventure says the Nibbio is not in a category with the big American twin-engine executive airplanes, but that its performance and economy will make it a worthwhile investment as an alternate when only two or three people have to make short trips by air.

### Company Guaranty

The company guarantees a 185-mpg cruise speed, and 41 hours 600 hp per year for a professional pilot—an annual operating cost of just over three cents per passenger mile.

Airplane meets both Italian and U.S.

manufacture requirements in several categories. Price is \$25,900 from Nibbio, and optional radio equipment such as 24-channel VHF and radio compass will raise the final equipped price to \$29,000.

All cost figures are based on current prices in Italy, which are almost directly comparable to U.S. prices.

Nibbio is one of a progressive family of sport and executive airplanes designed by Guido Fieschi, chief designer Italian aeronautical engineer and professor at the Politecnico di Milano. Direct predecessor of the Nibbio was the T-5 Tikes, a single-engine transport sport

## SAVE UP TO 90% OF COSTS WITH ALCOA PREMIUM CASTINGS

Alcoa's Premium Castings permit enormous savings in the production of aircraft components which formerly required extensive machining. For example—some especially complicated impeller cast in aluminum have resulted in savings of 90 per cent, or \$1,000 less than machined pieces. And they meet every requirement for high strength and smooth surface finish.

Impellers are existing stress. They spin at tip speeds up to 2,500 fpm (80,000 rpm for a 9 1/2" diameter part). Cast with Alcoa premium-strength C155-T6 aluminum alloy, properties are guaranteed in the casting. The smooth, curving blades, often tapering to a delicate 1/4" edge, have .003"

to .010" tolerances. Even difficult shrouded impellers with cored air passages, which are cast with a surface finish guaranteed to 125 microinch maximum, actually run 30 to 90 microinches in most cases.

Alcoa has steadily been refining its ability to produce high-speed rotating parts since 1944. Research through spin-testing, stress analysis, high-strength plastic cast molding and new alloys has evolved this unique process with exceptional cost savings.

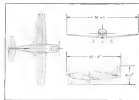
The premium-casting process, so successful with highly stressed impellers, is an exclusive Alcoa development. For information about saving on your machining costs with Alcoa's

premium-casting process, call your Alcoa sales engineer. Or write: Alcoa-Miles Company of America, 1300-G Alcoa Building, Pittsburgh 19, Pa.

Manufactured Pursuant to Alcoa C155 Premium Strength Castings, 3400, MIL-C-11105. Type I-A to highly stressed engine parts.

	Maximum Rev.	Type I
RTS, rpm	11,500	12,000
TS, psi	11,000	16,000
TS, %	10	10

Your Guide to the Best in Aluminum Sales



CABIN size of Nibbio (left) is 1.6 ft with 7.7 ft long and 3.9 ft high. There is baggage space behind the seat which can be reached during flight. Controls (right) are all within easy reach of the pilot. Pilot position and instrument panel are conventional.

# THE SKY IS

# NO LONGER THE LIMIT

Under the water, on the water... on land... in the air... and out into space... in all these areas Hughes advanced technology is being applied to vital military and commercial electronic programs.

In the space satellite field, for example, Hughes is active in the preliminary design of guidance and control systems, communication and telemetry systems, and sensing devices using infrared, optical and radar techniques.

Responsible for guiding and formulating the advanced systems concepts that make for new product developments possible is the Systems Analysis. Its current thinking has centered such new Hughes projects as advanced ballistic missile guidance, space vehicle systems, and tactical missile systems. Other new programs initiated by Hughes Systems Analysis include advanced radar systems for all areas of military and civilian applications, including ABC/3M, missile

guidance, early warning, air traffic control, and integrated electronic systems for underway warfare.

Currently the Hughes Research and Development Laboratories are engaged in the greatest expansion in their history. Professional opportunities have never been more promising, especially in the most recent areas such as Systems Analysis.

Other Hughes activities for the participating in the company. Hughes is presently developing and producing advanced three-dimensional radar systems. Hughes Products, the commercial activity of Hughes, is producing an electronic system which automates a complete line of machine tools.

Today Hughes offers Engineers and Physicists the opportunity of locating with an established firm and working in advanced new technical fields.



The wide range of activity at the Hughes Facilities facility extends from basic data processing and simulation radar research through final design and packaging.



Advanced optical studies conducted by the Hughes Research Laboratories include fundamental research in the physics and chemistry of atomic systems of laser transmitters and development of laser-based devices.

New commercial and military contracts have resulted in immediate and far expansion in the following areas:

Circuit Design	Acoustics
Reliability	Vacuum Tubes
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Nuclear Electronics	Computer Engineering

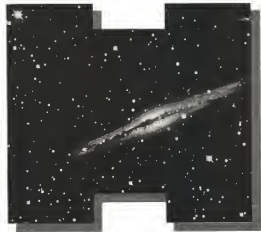
Write in confidence to Mr. Paul N. Joch, Hughes General Office, RMG-62, Culver City, California.

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Networks' new, truly accurate, precision Resistor series are available in 1/4, 1/2, 1 and 2 watt ratings to 100°C ±0.1% to 175 Watts. For 125°C available in special order. Lug types or flexible leads. Test results prove substantial improvement over MIL specs. They combine remarkable stability, under load and in the field, with exceptionally low temperature coefficients.

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plane, that cockpit needs retract all over Europe.

The L-14 follows the T-61's formula and is primarily a scaled-up version of that airplane. It is a single-engine four-seater, all-wooden airplane, with plywood and fabric covering. The cockpit is a listening 0.100 mfd at 150 hp driving a Hartzell constant-speed propeller. Fuel is 30.4% octane, carried in two wing tanks and one fuselage tank with a total capacity of 55 U.S. gal.

Crash weight of Nimbus is 2,550 lb. This figure is also the maximum landing weight. Empty weight is 1,500 lb. Normal wing loading is 15.4 psf, and power loading is 14.11 hp/hp.

Fuselage structure is monocoque, and is broken down into two sections joined together. Cabin size is 5.8 ft wide, 7.5 ft long and 19 ft high. There is luggage space behind the seat which can be reached during flight.

Flap position is conventional at 15° in the maximum lift position. The cabin is large, and controls are all within easy reach of the pilot.

Wing profile is NACA 6400 series with 11% thickness ratio at the root and 10% at the tip and a 4-deg washout. Wingspan is 31.2 ft, and area is 128 sq ft. Flaps have an 80% lift.

Thrust loading per sq ft is excellent,

retractable with a mechanical standby system.

First impression on entering the Nimbus is that of roominess and roominess of the entire cabin. Lower cockpit checklist is routine, and simple. It is listing about 2,000 rpm, back the plane back and check off each on gear, an additional 200 rpm, status 50-deg, turn gauges. With two-wheel steering in, the rubber pedals ground maneuvering is easy.

### Takeoff Data

In takeoff with 38 deg flap deflection, nosewheel leaves the ground at an indicated 47 mph and the plane is airborne at about 65 mph. Corrected takeoff distance is 900 ft.

Climb rate after takeoff with nose wheel continuous power and the air plane in clean configuration is 1,200 fpm at an indicated airspeed of 109 mph. With cruise power the rate is reduced to 700 fpm.

Stall and departure stallability is positive, and characteristics are good.

Still warning is a ballistics chart starts about 35 mph above the stall, rate of altitude is not more than 100 ft.

With power on and the engine idling, the stalling speed is 31 mph.



### Chemical Dispenser in Production

Wedge-shaped, portable dispensing unit mounted under wings of Stinson agricultural airplane is designed to permit pilots to spray dust and/or fertilizer by simply switching a cockpit control, allowing them to use time-consuming equipment elsewhere. Seeds may now be sown from 50 ft. to 180 ft., flow rates can be modified from one to 450 gals/sec, the product of the new Swallowtail dispensing unit. Eastland Aircraft reports. Designed to permit dual application for better Swallowtail consists of a stainless steel, corrosion resistant assembly, made up of two main panels and a center section in which material is stored and agitated. In the front of the unit is an intake, taking 180 cu. ft. of raw material. On top of the unit are production for dispensing dust and liquids, underpressure is lowered to release pellets and seed. Complete installation weighs about 115 lb.



## ROLLS-ROYCE DEVELOPMENTS

### Air Cooled Turbine Blades in Service

The latest Rolls-Royce Avon turbo jet engines in squadron service have air cooled turbine blades. This feature permits the use of higher gas temperatures, giving an increase in thrust per pound of engine weight, without affecting blade life.

The proving of this advanced feature in squadron service has established its basic reliability and air cooled turbine blades will be incorporated in the later marks of Rolls-Royce turbo jets and prop-jets for civil air transport.

### —another technical advance in

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### Air Surveyor

Airco Commercial 600 Super light twin business plane is being serviced by Spartan Air Services, Ottawa, for extensive serial survey of Canada's northern provinces. Umpa Dupa ordered the 600 Super will fly more than 700 hr. Her summer covering more than 110,000 sq miles will double.

first and second. First has magnetically mounted in tall boxes, with diameter 30 cm. Spots C-4 Gyrojet compass, Handy HIR-10 high frequency communications radio, dual AEC video compass and Navaplanette VME radio. An Arroyo's compass strap fits around it mounted in the video box.

with power off, the same configuration holds at 55 mph. Stalls are gentle and recovery is almost self-initiated by the airflow.

Full-throttle level flight can produce a maximum speed of 205 mph. Maximum cruise speed is 192 mph, normal cruise is 189 mph, and most economical cruise is 168 mph at 5,000 ft.

In the pattern, gust is lowered below 124 mph, and the flaps go down at about 112 mph or less. Normal pattern speed is about 99 mph, and after flarout, the airplane tracks down at about 77 mph. Landing was completed at about 400 ft.

The compass gauges a range of over 800 m at maximum balanced weight, and the slides to climb over mountains of 17,000 ft which cross European vegetation by a safe margin.

### Cost Accounting

Asselmann calculates cost of Nibco operations in the steel centers, using figures that apply in Italy. While cost comparison with U.S. prices is not possible, the over-all difference isn't too much and can be easily fixed.

For example, the salary for a professional pilot in Italy is lower than in the U.S., in balance, fuel and oil prices are higher in Europe than in America.

Can analysis overcome that the sig.

plane is fully equipped, valued at \$370,000, that total willingness is 990 hours per year at a block speed of 188 mph, and that the airplane is depreciated over a five-year period with 20% residual value at the end of that term.

Certain costs remain common to the analysis regardless of whether or not the plane is flown by a professional pilot. They are fuel and oil at the average European price, \$3.70; depreciation, \$5,200; hangar rents and landing fees, \$400; miscellaneous insurance (liability), \$125; importation and controls, \$500. Miscellaneous costs which include charts, supplies, aircraft dues, etc., come to \$400 for the private operator, and \$450 if a professional pilot is hired.

With a professional salary of \$4,500 per year and interest and engine maintenance of \$1,750. Total annual cost is therefore \$6,250, which breaks down into operating figures of \$75.60 per aircraft hour, 12.5 cents per aircraft mile, and 51 cents per passenger mile.

Without a professional pilot there is no salary allotment, and the normal and engine maintenance is estimated to \$1,540. Total annual cost is therefore \$10,475 which breaks down into operating figures of \$17.59 per aircraft hour, 9.2 cents per aircraft mile, and 2.1 cents per passenger mile.

## PRIVATE LINES

Lockheed Jetstar Prototype No. 1, 100-inch, made round the U.S. speed flight in under 18 hr., covering the four consecutive 6,700-km. laps in 14 hr. 50 min. during time at an average speed of 456 mph. Top speed was 630 mph. Flight

flights ran from 0200 to 0400 AFB, Calif., to McClellan AFB, Wash., to Chapparral Falls, Minn., to McCoy, Mo., and back to Edwards. Much of the flight was at 13,000-16,000-ft altitudes. Plane was fitted with 640-gal. glove tanks on

ways, involving ranges from 1,140 ms to over 3,000 ms. Second of the jittered prototypes has been on a nationwide dissemination time to respondent computers.

**Yonkers Chateau (Fla)** Royal Air Force training base is being converted into an air resort for fishing fishermen visiting Lake Okechobee area. Swimming pool, tennis courts and other sports facilities are available.

Shipment of 635 rifles and handgun pistols was made by nine companies during April for a total dollar volume of \$10,598,000 compared with 436 units valued at \$38,991,000 the previous month. April deliveries included 548 aircraft of foreign origin or make, of which 96 were bi- or tri-engine. For the

"L·I·F·E  
with  
LEAR

THE ICEB MATHS



My job is being and demonstrating the LEAN 3-S-TAFF management that you will say makes me prejudiced. To this, I agree, because the first day I see master degrees, including all sorts of other languages that, when I'm not in the classroom, and could be with nothing but a few

On my 'chook-and'-flight in a rain storm I'd never before, indeed, using LIFE I'd never before, I approached five of the birds (24 approaches in two runs made). Thus I made an approach approach with the 1-5 approach which was even more than the one I had often thought I would have made. I had to make the only approach on LIFE while the 1-5 approach was the 24.

The L-E/LIFE combination is a great relief to me, especially when I'm flying in a microwave. I am (yes) in another airplane tomorrow, flying to Amsterdam and back! I'll make the day of heavy traffic easier, which will be a relief to me, greatly decreasing the chance of collision.

THE NAVAL ATTITUDE COMMAND INDOCAUSE gives me a class and social presentation of my subjects in depth of analysis. And in this approach I simply follow an assumed plan for students' personal development of the leader and give steps.

**THE SITUATION DISPLAY OVERLAYS** provides any guidance in relation to the identified items. With model an unlabeled break in the meantime, the L3B adds the assigned address and the the handling or break 1 being complete.

To be on the way, I simply push the buttons and I automatically maintain my desired altitude and bank. Even the wind correction is handled automatically and compensated for. And the **ATTITUDE INDICATOR** shows me my exact air angle and is cross-wing.

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Forward resume to: J. L. Mohr, Industrial Relations Manager, Rohr Aircraft Corporation, Chula Vista, California, Dept. 8



## WHO'S WHERE

(Continued from page 21)

### Changes

Alfonso Paul Florent, manager, C-130's application engineering, Commercial Engines Operations, Aircraft Co., Engine Division, General Electric Co., Cincinnati, Ohio. Also A. S. Johnson, manager facilities, Production Engine Department, and M. R. Bower, manager, research and development, in the Jet Engine Department, G.E. Aircraft Co., Engine Division.

George M. Rossmore, assistant vice president, The Benco-Woodley Corp., Los Angeles, Calif. J. A. Brubaker, the company's vice president manufacturing, takes over Mr. Rossmore's assistant position at plant manager and will also be in charge company operations of the Denver City operation.

Charles G. Hefley, director, sales, is in from West Incorporated Co., San Diego, Calif.

John Vial, Northeast area manager, General Electric Division of Linc. Inc., New Haven, Conn.

Lockheed Aircraft Corp.'s George D. Dyer, Wichita, Kan., has assumed the following responsibilities: James P. Lebo, assistant manufacturing manager; Paul N. Dolan, assistant chief engineer; F. V. Cleveland, chief structural design engineer; E. B. Gilson, polymer design division engineer.

Dr. George B. Swann, chief of engineering psychology, Lockheed Inc., San Diego, Calif.

Stanley M. Call, director, Ohio operations, Northern Division of Northrup Aircraft Inc., Cleveland, Ohio.

James W. Marshall, director, office operations, Kansas Aircraft Corp., Topeka, Kan. Mr. Marshall assumes an assistant vice president position. Donald E. Fink, vice president, is in from Lockheed.

Edward E. Wacker, director, vehicle-related matters, is in from Los Angeles, Calif. The Bend Co., Philadelphia, Pa. Ben McCarty, technical sales representative, is in from the Southern Division of Borg-Warner Corp., Cincinnati.

Harold N. Skatston, sales manager, is in from General Electric, Los Angeles, Calif. William Wagoner, product manager, is in from the Vehicle Division of Borg-Warner Corp., Cincinnati.

C. J. Thompson, district sales manager, is in from the Instrument Division of Robertson Electric Controls Co., Jackson, Miss.

Ralph P. Fisher, vice president, is in from the Instrument Division of Robertson Electric Controls Co., Jackson, Miss.

Malcolm J. Mork, assistant vice president, is in from the Western Division of Western Aircraft Co., New York, N.Y.

John J. Engel, assistant director, is in from the National Aircraft Co., San Diego, California.

George M. Thone, vice manager, is in from the Instrument Division of Robertson Electric Controls Co., Jackson, Miss.

Joseph H. Fitzgerald, general manager, is in from the Instrument Division of Robertson Electric Controls Co., Jackson, Miss.



## FLY WEATHER-WISE



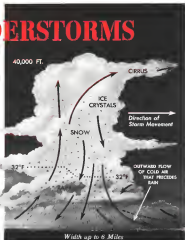
These weather items prepared in consultation with the United States Weather Bureau

# THUNDERSTORMS

SINCE most flyers avoid thunderstorms either visually or with radar, the only place they usually have to be reckoned with is their report during takeoffs or landings. Diagram is right indicates hazardous features of a mature thunderstorm.

Notice the wedge of rain cooled at the poles along the ground ahead of the storm. It is this rain of air due causes the pressure based on planes maneuvering in the vicinity. Very sudden wind shifts may develop in comparison and sudden drop in temperature can severely affect engine performance. Cold downdrafts precede and accompany heavy rain and are usually followed by updrafts in rear portion of storm.

Maximum turbulence occurs in region of heavy rain where downdrafts are closest to updrafts. It is encountered between 12,000 and 20,000 ft. Minimum hail occurs between 10,000 and 15,000 ft., sometimes as close as just outside cloud.



If forced to fly through storm, take following precautions. Prepare engine, deicing equipment and instruments for changing conditions. Avoid areas and other maneuvers after penetration. Avoid over-controlling, ride with the

drafts. Slow down to safe speed, but don't slow flap to accomplish this. Don't try to adjust throttle for every change in airspeed indicators which is affected by brief pressure changes and temp.

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THIS IS "THUNDERSTORMS" series with CIRRUS, the first book paper for home and studies.



Letters to Information, page 82, page 10



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Send detailed resume including salary requirements to:

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Curtiss-Wright Corporation, West-Eden, N.J.

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